Model 1100 Operator's Manual

MONARCH MEDICAL

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1100 MEMORY SET-UP WORKSHEET

Alarms	Parameters	Default High	Default Low	Range High	Range Low	Set-Up A	Set-Up B	Set-Up C	Set-Up D
	Heart Rate	180	40	80-240, Off	Off, 20-100				
	Percent SpO_2	Off	90	80-99, Off	Off, 70-95				
	Respiration Rate	35	2	20-90, Off	Off, 1-20				
	Temperature ° C	37.8C	33.9C	28.9-42.2, Off	Off, 28.9-42.1				
	Temperature ° F	100F	93F	84-108, Off	Off, 84-108				
	AP/NIBP Systolic	200	50	130-240, Off	Off, 40-120				
	AP/NIBP Diastolic	100	30	80-240, Off	Off, 20-120				
	AP/NIBP Mean	150	50	80-250, Off	Off, 25-90				
	PA Systoic	40	15	15-75, Off	Off, 1-25				
	PA Diastolic	15	5	5-50, Off	Off, 1-15				
	PA Mean	20	10	5-40, Off	Off, 1-20				
	CVP/ICP	15	1	5-20, Off	Off, 1-10				
	Minimum Inspired CO_2	5	n/a	n/a	0-24,Off				
	Expired CO_2	55	20	21-99, Off	Off, 0-76				
	Inspired O_2	100	18	19-100, Off	Off, 18-100				
	Expired O_2	100	Off	0-100, Off	Off, 1-100				
	Inspired N_2O	75	Off 2	0-80, Off	Off, 1-79	1cc 25		1cc 25	
	Expired N_2O	75	Off	0-80, Off	Off, 1-79				
	Inspired Hal	2.3	Off	0.1-5.0	Off, 0.1-5.0				
	Expired Hal	1.5	Off	0.1-5.0	Off, 0.1-5.0				
	Inspired Enf	4.8	Off	0.1-5.0	Off, 0.1-5.0				
	Expired Enf	3.2	Off	0.1-5.0	Off, 0.1-5.0				
	Inspired Iso	3.6	Off	0.1-5.0	Off, 0.1-5.0				
	Expired Iso	2.4	Off	0.1-5.0	Off, 0.1-5.0				
	Inspired Des	18	Off	0.1-18	Off, 0.1-18				
	Expired Des	12	Off	0.1-18	Off, 0.1-18				
	Inspired Sev (opt.)	5.1	Off	0.1-7.0	Off, 0.1-7.0				
	Expred Sev (opt.)	3.4	Off	0.1-7.0	Off, 0.1-7.0				
	Apnea	n/a	20 seconds	n/a	10-60, Off				
	Asystole	n/a	20 seconds	n/a	3-20, Off				

Parameter	Settings	Set-Up A	Set-UpB	Set-Up C	Set-UpD
VOLUME					
Alarm volume	off, 10-100% default is **50%**				
System error volume	off, 10-100% default is **50%**				
Heartbeat volume	off, 10-100% default is **50%**				
WAVEFORM CONFIGURATIONS					
Waveforms Defaults: #2 **IBP1** #3 **Plethysmograph** #4 **Capnograph**	IBP Ch1, IBP Ch2, IBP Ch3, Capnograph, Plethysmograph (also, ECG Ch2 for Waveform #2 only)				
HEART RATE AND RESPIRATION RATE SOURCE					
Heart rate source	**smart**, ECG Ch1, IBP Ch1, IBP Ch2, SpO_2				
Respiration rate source	smart, **$etCO_2$**, Impedance				
DATE AND TIME					
Date:					
Month Day	1-12 1-31				
Time: Hour Minute	 0-23 0-59				
Year:	0-99				
1120 RECORDER					
Recorder mode	On Demand, Periodic, Continuous, **Off**				
BP output	**NIBP**, IBP (Ch1, Ch2, Ch3)				
Record delay	0, **8**, 16 sec.				
Record interval	NBP, 1, 2, 3, 4, **5**, 10, 15, 20, 30, 60 min.				
Record on alarm	Yes, **No**				
Recorder speed	6.25, 12.5, **25**, 50 mm/sec				

Parameter	Settings	Set-Up A	Set-UpB	Set-Up C	Set-UpD
1120 RECORDER (cont.)					
Analog channels A, B, C Defaults: A **ECG Ch1** B **Plethysmograph** C **Capnograph**	off Waveforms: Test, Capnograph, Plethysmograph IBP Ch1, IBP Ch2, IBP 3, ECG 1, ECG 2 Temperature, Respiration rate, $etCO_2$, SpO_2, Heart Rate				
SERIAL OUTPUT					
Serial output mode	**Off**, Standard, VitalView				
BP output	**NIBP**, IBP, CH (1, 2, 3)				
ECG output	Yes, **No**				
ASCII PRINTER					
Printer mode	Off, **On Demand**, Periodic,				
BP output	**NIBP**, IBP, CH (1, 2, 3)				
Print interval	NBP, 1, 2, 3, 4, **5**, 10, 15, 20, 30, 60 minutes				
Print on alarm	Yes, **no**				
Baud rate	1200, 2400, 4800, **9600**				
Agent set	**Hal/Enf/Iso**, Hal/Sev/Iso (Sev units) **Hal/Enf/Iso**, Hal/Des/Iso (Des units)				
ECG					
ECG Type	**3**, 5 Leadwire				
Sweep rate	12.5; **25**; 50 mm/sec.				
Resp Sens	Low, Med, **High**				
IBP					
Ch1 type	**AP**, PA, CVP, ICP				
Ch1 scale	20, 40, 80, 120, **200**, 300 mmHg				
Ch2 type	AP, **PA**, CVP, ICP				
Ch2 scale	20, **40**, 80, 120, 200, 300 mmHg				
Ch3 type	**CVP**, ICP				
Ch3 scale	10, **20**, 40, 80, 120, 200 mmHg				
NIBP					
NIBP cycle time	Off, 1, 2, **3**, 4, 5, 10, 15, 20, 30, 60 min				
NIBP mode	**Adult**, Neonate				

Parameter	Settings	Set-Up A	Set-UpB	Set-Up C	Set-UpD
	TEMPERATURE				
Temp degrees	**Fahrenheit** Centigrade				
	SpO2				
SpO_2 Scale	**X1**, X2, X4				
UltraSync	On, **Off**				
Search time	**40 sec**, 10, 20, 30 sec.				
Search warning	**On**, Off				
	GASES				
Gases Waveforms Sweep rate	**12.5**, 25, 6.25, 12.5 mm/sec.				
CO_2 units	**mmHg**, KPa				
CO_2 scale	**60mmHg**, 100 mmHg				
CO_2 waveform	**Full screen**, Split screen				
Parameters Flow rate	50, **150 ml/min**				
CO_2 meter	On, **Off**				
N_2O comp	On, **Off**				
N_2O/O_2 ration	0/95; 0/50; 0/21; 70/25; **60/35**; 50/45; 40/55; 30/65				
	DISPLAY				
Display	One, Two, **Four Waveform**				
Trends Tabular trends Interval	1, 2, 3, 4, **5**, 10, 15, 20, 30 min				
Graphic trends Select trends Trend #1	**H.R.**; SpO_2; $etCO_2$; R.R.; IBP Ch1; IBP Ch2; NBP; Temp; None				
Trend #2	H.R.; **SpO_2**; R.R.; IBP Ch1; IBP Ch2; NBP; Temp; None; H.R.				
Trend #3	SpO_2; **$etCO_2$**; R.R.; IBP Ch1; IBP Ch2; NBP; Temp; None				
Trend #4	H.R.; SpO_2; $etCO_2$; R.R.; IBP Ch1; IBP Ch2; **NBP**; Temp; None				
Trend length	**1, 8 hour**				

Warranty

Workmanship & Materials

Criticare Systems, Inc. (CSI) warranties new equipment other than the 517 Multi-Site Sensor and 644 O_2 Sensor to be free from defects in workmanship and materials for a period of one (1) year from date of shipment under normal use and service. The 517 Multi-Site Sensor and the 644 O_2 Sensor carry a six month warranty. CSI's obligation under this warranty is limited to repairing or replacing, at CSI's option, any part which upon CSI's examination proves defective.

THIS WARRANTY IS EXPRESSLY IN LIEU OF, AND CSI MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

Exemptions

CSI's obligation or liability under this warranty does not include any transportation or other charges or liability for direct, indirect or consequential damages or delay resulting from the improper use or application of the product or the substitution upon it of parts or accessories not approved by CSI or repair by anyone other than a CSI authorized representative.

This warranty shall not extend to any instrument which has been subjected to misuse, negligence or accident; any instrument from which CSI's original serial number tag or product identification markings have been altered or removed; or any product of any other manufacturer.

Safety, Reliability, and Performance

Criticare Systems, Inc. is not responsible for the effects on safety, reliability and performance of the 1100 Patient Monitor if:

- assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons other than those authorized by Criticare Systems, Inc., or
- the 1100 Patient Monitor is not used in accordance with the instructions for use, or
- the electrical installation of the relevant room does not comply with NFPA 70:National Electric Code or NFPA 99: Standard for Health Care Facilities (Outside the United States, the relevant room must comply with all electrical installation regulations mandated by the local and regional bodies of government).

In Case of Emergency, Contact

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20925 CROSSROADS CIRCLE
WAUKESHA, WI 53186
TELEPHONE: (414) 797-8282
TELEX: 5106012199
TELEFAX: (414) 797-8104

CSI - INTERNATIONAL
c/o MEDLOG GMBH
GÖTZENMÜHLWEG 66
6380 BAD HOMBURG
GERMANY
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TELEX: 418113
TELEFAX: 49-6172-32053

Service/Return Policy

Service Manual

An 1100 Patient Monitor Service Manual (Catalog No. 1112) is available for technical personnel to repair parts of the equipment which are defined as serviceable. The manual includes circuit diagrams, component part lists and descriptions.

Return Procedure

In the event that it becomes necessary to return a unit to Criticare Systems, Inc., the following procedure should be followed:

1. *Obtain return authorization.* Contact the CSI Service Department at 800-458-2697 to obtain a Customer Service Authorization (CSA) number. The CSA number must appear on the outside of the shipping container. Return shipments will not be accepted if the CSA number is not clearly visible. Please provide the model number, serial number, and a brief description of the reason for return.

2. *Freight policy.* The customer is responsible for freight charges when equipment is shipped to CSI for service (this includes customs charges).

3. *Loaner service.* If it is necessary to provide a loaner system, CSI will ship a loaner by Federal Express at our expense. The loaner system must be returned at the customer's expense within one week after receipt of the repaired goods. If the unit is not returned to CSI within that time, the customer will be invoiced for the full purchase price of the equipment.

TO ACCESS PRESET SET UPS - PRESS MONITOR SET AND SELECT SET UP REQUIRED

SET UP - A	SET UP - B	SET UP - C	SET UP - D

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Table of Contents (continued)

Section 1 -- Introduction

Section 1 — Introduction

1100 Patient Monitor

The 1100 Patient Monitor is a fully integrated vital signs monitor. It monitors all critical parameters. The 1100 offers complete patient monitoring in a single integrated, cost-effective system. The 1100 incorporates all American Society of Anesthesiologists recommended monitoring modalities:

- ECG
- Blood pressure
- Oxygen saturation
- Capnography
- Oxygen delivery
- Respiration
- Temperature

In addition, the 1100 monitors the concentration of anesthetic agent and nitrous oxide being delivered to the patient by the anesthesia system.

UltraSync™

UltraSync™ correlates the ECG signal to the plethysmographic waveform obtained from the oxygen saturation sensor. The correlation enhances the performance of the oximeter in low perfusion states and reduces the effect of motion artifact. It is recommended that UltraSync™ be used in low perfusion states such as hypothermia and shock, and when motion may affect readings, such as during stress testing and transport.

About This Manual

The information in this manual is arranged so that you can read the manual cover to cover to become familiar with the operation of the 1100 Patient Monitor. When you are familiar with the basic 1100 operation, use the table of contents and index as references to assist in finding specific information.

Section	Title	Purpose
1	Introduction	Familiarizes you with the 1100, its safe operation and this manual
2	Operator Controls	Explains the operator controls, their location and how they work
3	Setup Procedures	Describes setting up and getting ready to use the 1100
4	Setting Parameters for Vital Signs	Provides step-by-step procedures for setting parameter limits
5	Viewing Patient Data	Explains the various view modes and how to select one
6	Periodic Maintenance	Describes maintenance procedures

Specifications

The following specifications are subject to change without notice:

ECG

Lead Selection	I, II, III, aVR, aVL, aVF, V
Gain Selection	1/2 mV, 1 mV, 2 mV, 4mV full scale
Frequency Response	Diagnostic: 0.05-100 Hz (-3db) Monitor: 0.50-40 Hz (-3db)
Isolation	Breakdown voltage: 4000 VAC 60 Hz Leakage current: <10μA
Sweep Speed	12.5, 25, 50 mm/sec
Electrosurgery Protection	Yes
Defibrillation Protection	Yes
Pacer Rejection	Yes

Specifications (cont.)

HEART RATE DISPLAY AND ALARMS

Range	20-250 bpm
Update Time	Every beat
Accuracy	± 1 bpm
Alarm Limit Range	80-240 bpm (high) 20-100 bpm (low)
Alarm Indication	Audible, visual
Alarm Silence	Yes

NON-INVASIVE BLOOD PRESSURE

Technique	Oscillometric on deflation
Cuff Deflation	<2 sec (250 mmHg: std. adult cuff)
Measurement Cycle	(0-250 mmHg: std. adult cuff) <30 sec average
Automatic Measurement Cycles	1, 2, 3, 4, 5, 10, 15, 20, 30, 60 min

INVASIVE PRESSURE 3 CHANNELS

Isolation Breakdown Voltage:	4000 VAC 60 Hz Leakage current: @10µA
Pressure Range	0-300 mmHg
Zero Offset	± 41 mmHg
Probe Impedance	300-3500 input ohms
Frequency Response	0-20 Hz
Input Impedance	820 K Ω @ 20 Hz >100 M Ω @ D.C.
Transducer Sensitivity	5 µV/V/mmHg
Zero	Auto pushbutton
Drift	± 1 mmHg
Accuracy:	± 1%
Scale Ranges	-10 to 10, 0 to 20, 0 to 40, 0 to 80, 0 to 120, 0 to 200, 0 to 300
Display	Systolic, diastolic, mean pressure

TEMPERATURE

Range	20-45° C 68-113° F ± 0.5° C (20-34° C)

Specifications (cont.)

	±0.2° C (34-41° C)
	± 0.5° C (41-45° C)
Display Resolution	0.1° C or 0.1° F
Probe	YSI-400 series

OXYGEN SATURATION ($\%O_{2}$)

Range	0-99%
Resolution	1%
Accuracy	± 2%, (70-99%)
	± 3%, (40-70%)
Sensor Type	Dual Wavelength LED
Hi Sat Alarm Range	Off, 80-99%
Resolution	1%
Low Sat Alarm Range	Off, 70-95%
Resolution	1%

PNEUMATIC SYSTEM

Disposable Water Chek™ with 8' sample line

$etCO_2$

Range	0-99 mmHg
Resolution	1 mmHg
Scale	0-60 mmHg
	0-100 mmHg
Accuracy	± 2 mmHg
Sensor Type	Non-dispersive, infrared absorption
Sensor Location	Internal (side stream)
Sample Rate	50, 150 ml/min
Response Time	250 ms 10-90% step or within 1db to 80 bpm
Sweep Speed	6.25, 12.5, 25 mm/sec
Autocalibration	Yes
Alarms	1-99 high
	0-99 low
	0-10 minimum inspired

Specifications (cont.)

AGENTS

NOTE A flow rate of 150 ml/min is recommended. Use of 50 ml/min may require derating of gas monitoring specifications.

Halothane Range	0-7%
Enflurane Range	0-7%
Isoflurane Range	0-7%
Sevoflurane Range	0-9.9% (for units with Sevoflurane capability only)
Resolution	0.1%
Accuracy	Single gas: ± 0.2% 0-3% ± 0.3% 3-9% Mixed gas: ± 0.2% 0-3% total ± 0.3% 3-9% total
Rise Time	680 ms 10-90% step or within 1db to 30 bpm
Sensor Type	Infrared
Alarm Limit	0-5.0% inspired and expired (sevoflurane alarm limit is 0-9.0%)

N_2O

Range	0-80%
Resolution	1%
Accuracy	± 5%
Rise Time	680 ms 10-80% step or within 1db to 30 bpm
Sensor Type	Infrared
Alarm Limit	0-80% inspired and expired
Compensation	Automatic* or operator selectable, mathematical compensation for 50-70% N_2O inspired and expired.

O_2

Range	0-99%
Resolution	1%
Accuracy	± 3%
Rise Time	550 ms 10-90% step or within 1db to 40 bpm
Sensor Type	Galvanic Cell
Alarm Limit	18-99% inspired 0-99% expired

*Compensation is done manually for Model 1100-3.

Specifications (cont.)

RESPIRATION

Rate	0-99 breaths/min
Resolution	1 breath/min
Accuracy	± 2 breaths/min
Apnea	10-60 seconds

TRENDS

Graphic	8 hours/1 hour
Memory	8 hours

DISPLAY

Type	CRT
Screen Size	9 inches diagonal
Max Traces	4

DIMENSIONS

16" W x 8½" H x 18" D
39 lbs (Model 1100-4)

POWER REQUIREMENT

Power	80 W (max)
Voltage Input	110 Volts/60 Hz, 220 Volts/50 Hz
Battery Life	Approximately 20 minutes

BACK PANEL OUTPUTS AND CONNECTORS

Strip Chart Recorder	DB-9, for Criticare 1120 printer
Computer Interface	DB-9, RS-232, serial port
External Monitor	DB-9 for remote display
Analog Outputs	3 channels, 0-1V

NOTE Performance of the monitor may be adversely affected by exposure to high levels of electrostatic discharge.

Method of Measurement

Oxygen Saturation

DEFINITION

Hemoglobin exists in the blood in several forms:

- Oxygenated (bound to oxygen, O_2 Hb)
- Reduced (not bound to other molecules, Hb)
- Dyshemoglobins (carboxyhemoglobin and methemoglobin).

The 1100 Patient Monitor defines arterial oxygen saturation as the ratio of oxygenated hemoglobin to the total amount of hemoglobin available for binding to oxygen.

$$\% \text{ oxygen saturation} = \frac{\text{Oxyhemoglobin}}{\text{Oxyhemoglobin + Deoxyhemoglobin}} \times 100$$

Dyshemoglobins, such as carboxyhemoglobin and methemoglobin, are not directly measured and therefore are not factored into the measurement.

METHOD

The 1100 Patient Monitor's pulse oximeter measures oxygen saturation and pulse rate by using the principles of spectrophotometry and plethysmography. The oxygen saturation sensor contains LEDs which emit two specific wavelengths of light through a pulsating vascular bed. The sensor is completely non-invasive. There is no heat source that could burn a patient.

Since O_2 Hb and Hb absorb light selectively and predictably, the amounts of these two compounds can be determined by measuring the intensity of each wavelength that passes through the measuring site. A photodetector located opposite the light source measures the intensity of each wavelength transmitted through the monitoring site. The light intensity is converted to an electrical signal which is input to the monitor. The effects of skin pigmentation, venous blood, and other tissue constituents are eliminated by separating out the pulsating absorption data.

End-Tidal CO_2

DEFINITION

End-tidal CO_2 ($etCO_2$) is defined as the maximum CO_2 concentration at the end of expiration. The 1100 Patient Monitor measures CO_2 inhalation and exhalation concentrations and shows them as numerical values as well as showing a waveform. Each CO_2 waveform represents an inhalation/exhalation cycle.

Like pulse oximetry, capnography provides continuous non-invasive information that aids the clinician in assessing a patient's cardiopulmonary function and metabolic state. It is extremely helpful in determining the efficacy of various respiratory treatments. Capnography can be used to detect esophageal intubations, disconnections, apnea and malignant hyperthermia.

METHOD

Gas is aspirated from the patient's airway or breathing circuit at a user selectable rate of 50 or 150 ml/min. The gas sample enters the Water Chek™, a specially designed chamber which removes water vapor and particulate matter from the gas sample. The dry gas then enters the CO_2 detector where it is analyzed.

The 1100 Patient Monitor measures $etCO_2$ using the principles of infrared absorption spectrometry. An unknown concentration of gas (CO_2) is calculated by comparing its absorbance of infrared light to that of a known standard. The absorption of light is directly proportional to concentration of the gas. As infrared light passes through the sample gas chamber the light transmitted is converted to a voltage signal. The capnometer converts the voltage to CO_2 concentration and expresses it in mmHg.

The 1100 Patient Monitor's pneumatic system utilizes two pumps. The primary pump controls the flow of gas under normal operation. If the system senses an occlusion, a secondary pump is automatically activated to clear the occlusion from the line. When the line is clear, the system returns to using only the primary pump. Valves are located throughout the 1100 Patient Monitor's pneumatic systems to prevent any backflow of gas.

Oxygen and Nitrous Oxide Monitoring

DEFINITION

The 1100 Patient Monitor defines the O_2 measurement as the fractional amount of O_2 in the gas delivery system. This measurement is useful to determine the adequacy of the gas delivery system. Inspired oxygen measurement provides early warning of insufficient oxygen delivery. In addition, the 1100 Patient Monitor uses real time O_2 measurement to compensate for the effect of O_2 on $etCO_2$ readings.

METHOD

The 1100 Patient Monitor measures fractional oxygen using a galvanic sensor. The galvanic sensor operates on the electrochemical principle, where the rate of reduction of oxygen is proportional to its partial pressure.

Gas is sampled from the patient's airway. It enters the 1100 Patient Monitor through the Water Chek™ and arrives at the oxygen bench. The oxygen bench has stainless steel ports for gas to enter and exit a sample chamber, where oxygen makes contact with the diffusion membrane of the sensor.

Although the oxygen sensor gives a signal which is proportional to oxygen partial pressure, the 1100 Patient Monitor is calibrated to display the fractional concentration. This number is automatically corrected for variations in pressure, temperature and flow. In addition, the response time of the sensor is electronically compensated for true measurement of the inspired and expired concentrations.

The calibration of the oxygen channel is automatic throughout the life of the sensor. When replacing the sensor, a one time field calibration is necessary. The nominal lifetime of the sensor is twelve months.

NITROUS OXIDE MONITORING

Inspired and expired nitrous oxide measurement allows the clinician to monitor fluctuation in patient absorbtion. In addition, the 1100 Patient Monitor uses real time N_2O measurement to compensate for the effect of N_2O on $etCO_2$ readings. (Compensation is done manually on Model 1100-3.)

The 1100 Patient Monitor measures nitrous oxide using the principles of infrared absorption spectrometry similar to the $etCO_2$ measurement.

Halogenic Anesthetic Agent Monitoring

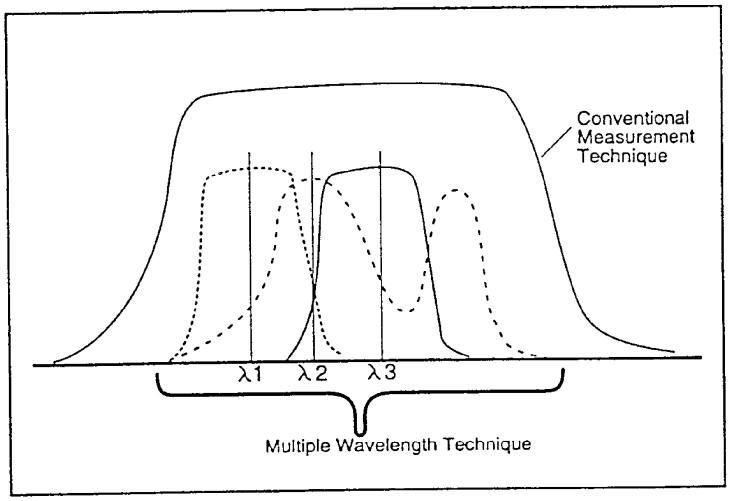
DEFINITION

The 1100 Patient Monitor defines halogenic agent concentration as the fraction of agent present in the total quantity of gas, expressed as a percent. Accurate monitoring of inspired agents allows for precise dosing and reduces the risk of misdosage due to vaporizer malfunction, miscalibration, or leaks in the vaporizer circuit. True measurement of expired agent concentration indicates alveolar concentration. This allows for assessment of anesthesia depth during all phases of anesthesia and provides a valuable predictor of the duration of unconsciousness at recovery.

Automatic detection of the wrong anesthetic agent warns the clinician of possible catastrophic circumstances including selecting the wrong vaporizer, or filling the vaporizer with the wrong agent. Mixed agent detection is very useful in warning of possible malfunction of multiple vaporizer systems, contaminated vaporizers, or rebreathing of agent mixtures.

METHOD

The 1100 Patient Monitor measures halogenic anesthetic agent concentration using the principles of infrared absorption spectrometry. To measure the concentration of anesthetic agent present, infrared light is passed through a sample of gas. The agent will absorb different amounts of energy at different wavelengths of light, depending on the type and amount of anesthetic agent present. The beam of light is then filtered at wavelengths where the anesthetic agents are known to absorb energy; making the strength of the beam related to the amount of the agent present. A detector converts the beams into electrical signals which can be processed by the monitor in order to provide a reading of the agent's concentration. A major limitation of conventional infrared analyzers is that they look at only one wavelength of light. Because of this, they can only measure one agent at a time. The Criticare Systems, Inc. anesthetic agent monitor can identify the anesthetic agents because it uses several wavelengths of light, each accentuating a particular agent. The following figure illustrates the concept of agent detection using several wavelengths.


Conventional
Measurement
Technique
λ1
λ2
λ3
Multiple Wavelength Technique

Safety

Symbols

Symbol	Means
	Alternating Current
	CF Equipment Type
	Defibrillator Proof Type CF
	Equipotentiality

Warnings and Cautions

Special notice statements are preceded by the words Warning or Caution printed in boldface type. These statements contain important safety instructions.

Warning means there is the possibility of personal injury to you or others.

Caution means there is the possibility of damage to the equipment.

Temperature

⚠ WARNING ⚠

USE A SANITARY TEMPERATURE PROBE FOR EACH PATIENT. IF A CLEAN, SANITARY TEMPERATURE PROBE IS NOT USED FOR EACH PATIENT, DISEASES COULD BE TRANSMITTED.

⚠ CAUTION ⚠

Use care not to stretch internal temperature probe and cable wires. Store probes and cables carefully after forming them into loose loops. If internal wires are stretched, mechanical failures could result.

Electrical

⚠ WARNING ⚠

USE THE 1100 PATIENT MONITOR ONLY WITH THE SUPPLIED CRITICARE POWER CORD. USE OF A NON-APPROVED CORD MAY CAUSE SHOCK TO THE OPERATOR OR PATIENT.

⚠ WARNING ⚠

BE SURE THE POWER PLUG IS CONNECTED TO THE 1100 MONITOR BEFORE YOU PLUG THE CORD IN TO AN ELECTRICAL OUTLET. USE HOSPITAL GRADE OUTLETS ONLY.

⚠ WARNING ⚠

THE CONDUCTIVE PARTS OF THE LEAD ELECTRODES AND ASSOCIATED CONNECTORS FOR TYPE CF ELECTROCARDIOGRAPHS, INCLUDING THE NEUTRAL ELECTRODE, SHOULD NOT COME IN CONTACT WITH OTHER CONDUCTIVE PARTS INCLUDING EARTH. SUCH CONTACT COULD RESULT IN PATIENT INJURY OR DEATH OR EQUIPMENT DAMAGE.

⚠ WARNING ⚠

THE MODEL 1100 PATIENT MONITOR HAS BEEN DESIGNED WITH PROTECTIVE MEANS AGAINST BURNS OF THE PATIENT WHEN USED PROPERLY WITH HF SURGICAL EQUIPMENT. IT IS IMPERATIVE THAT THE OPERATOR GUARANTEES THE INTEGRITY OF THE HF SURGICAL NEUTRAL ELECTRODE CONNECTION. NON-COMPLIANCE COULD RESULT IN BURNS TO THE PATIENT.

Electrical (cont.)

⚠ WARNING ⚠

IF THE INTEGRITY OF THE EXTERNAL PROTECTIVE EARTH CONDUCTOR ARRANGEMENT IS IN DOUBT, THE POWER CORD SHOULD BE DISCONNECTED AND THE MACHINE SHOULD BE OPERATED FROM ITS INTERNAL ELECTRICAL POWER SOURCE.

⚠ CAUTION ⚠

Do not apply more than 5VDC to the connectors on the monitors rear panel. More than 5VDC could cause damage to the equipment.

⚠ CAUTION ⚠

Assure adequate battery power at all times, charge the unit following extended battery use.

NOTE

The 1100 Patient Monitor itself complies with leakage current limits required by medical safety standards for patient connected devices. There is a possible hazard caused by the summation of leakage currents when several pieces of equipment are interconnected.

NOTE

The equipotential terminal should be connected only to equipment that also complies with patient connected medical safety standards for leakage current.

ECG

⚠ WARNING ⚠

USE THE MODEL 1100 PATIENT MONITOR ONLY AS RECOMMENDED BY THE MANUFACTURER. DO NOT USE MODEL 1100 PATIENT MONITOR FOR INTRACARDIAC ECG APPLICATION. USING THE MODEL 1100 PATIENT MONITOR FOR INTRACARDIAC ECG APPLICATION COULD RESULT IN INJURY OR DEATH.

⚠ WARNING ⚠

USE THE 1100 PATIENT MONITOR ONLY WITH THE SUPPLIED CRITICARE ECG PATIENT CABLE AND LEADS. USE OF NON-APPROVED CABLES AND LEADS COULD CAUSE INJURY TO THE OPERATOR AND/OR PATIENT.

⚠ WARNING ⚠

DO NOT PLACE DEFIBRILLATOR PADDLES ON OR ADJACENT TO THE ECG PATIENT ELECTRODES. POSITION DEFIBRILLATOR PADDLES CLEAR OF THE ECG PATIENT ELECTRODES. CONTACT BETWEEN DEFIBRILLATOR PADDLES AND ECG PATIENT ELECTRODES COULD INJURE THE PATIENT.

⚠ WARNING ⚠

ECG ELECTRODES COULD CAUSE SKIN IRRITATION. EXAMINE THE ECG ELECTRODE SITES DAILY FOR SKIN IRRITATION. CHANGE THE ELECTRODES AND REPOSITION EVERY 24 HOURS OR SOONER IF THERE IS ANY SIGN OF INFLAMMATION.

ECG (cont.)

NOTE Criticare is not aware of any safety hazard due to the operation of a cardiac pacemaker or other electrical stimulators when used in conjunction with the Model 1100 Patient Monitor.

NOTE The ECG has been designed to be protected against the effects of cardiac defibrillator discharge.

Blood Pressure

Criticare assumes no responsibility for any invasive external blood pressure transducers used with the model 1100.

⚠ CAUTION ⚠

Do not use a BP cuff that does not fit the patient. Accuracy of blood pressure readings depends on using a properly sized cuff. The American Heart Association recommends that the width of the cuff should be either 40% of upper arm circumference or 2/3 of upper arm length.

⚠ CAUTION ⚠

If a patient experiences a sudden dramatic drop in blood pressure the system may not detect the pressure on the first attempt. The system will detect the change on the second attempt.

⚠ CAUTION ⚠

The accuracy of non-invasive blood pressure readings may be adversely affected by the presence of agents which alter the patient's cardiovascular dynamics.

⚠ CAUTION ⚠

The sensitivity of invasive and non-invasive blood pressure monitoring may be affected when used on patients with intra-aortic balloon pumps.

⚠ CAUTION ⚠

Interference or errors in readings may be caused by the presence of electrocautery or diathermy interference.

$etCO_2$

⚠ WARNING ⚠

DO NOT DISPOSE OF THE O_2 CARTRIDGE WHERE IT MAY BE INCINERATED. O_2 CARTRIDGE CONTAINS CAUSTIC MATERIAL. DISPOSE OF THIS CARTRIDGE IN ACCORDANCE WITH HOSPITAL REQUIREMENTS FOR CAUSTIC MATERIALS DISPOSAL.

⚠ CAUTION ⚠

Change the Water Chek™ and tubing for the $etCO_2$ every 24 hours or when the trap is 3/4 full. The sample line must be changed when it is occluded. A Water Chek™ is intended for single patient use.

⚠ CAUTION ⚠

After any calibration, check the calibration accuracy by running another known gas mixture through the monitor. This cross-check will verify that the monitor is calibrated properly.

Pulse Oximeter

⚠ WARNING ⚠

PULSE OXIMETER SENSOR COULD CAUSE SKIN IRRITATION. INSPECT THE PULSE OXIMETER SENSOR SITE EVERY FOUR TO SIX HOURS. MOVE SENSOR TO A DIFFERENT LOCATION IF ANY SKIN IRRITATION IS PRESENT.

⚠ CAUTION ⚠

The pulse oximeter sensor is light sensitive. Too much ambient light makes it impossible for the system to provide accurate readings. The system provides a high ambient light alarm when it is necessary to shield the sensor from extraneous light sources such as phototherapy light or infrared heating lamps.

⚠ CAUTION ⚠

Do not tape over the pulse oximeter sensor housing. Taping over the housing could cause injury and sensor failure due to too much pressure. If the sensor needs to be secured, place tape over the cable, immediately behind the sensor.

⚠ CAUTION ⚠

Do not place the pulse oximeter sensor on the same extremity with the blood pressure cuff or an arterial line. Place the pulse oximeter sensor on the side of the patient opposite the blood pressure cuff or an arterial line. The occlusion of the blood flow during blood pressure determinations could affect saturation readings.

⚠ CAUTION ⚠

Use care not to stretch internal probe and cable wires. Store probes and cables carefully after forming them into loose loops. If internal wires are stretched, mechanical failures could result.

General

⚠ WARNING ⚠

A POSSIBLE EXPLOSION HAZARD EXISTS. DO NOT USE THE 1100 PATIENT MONITOR IN THE PRESENCE OF FLAMMABLE ANESTHETICS.

⚠ WARNING ⚠

DO NOT OPERATE THE 1100 WITH ANESTHETIC AGENTS WITHOUT FIRST CONNECTING THE UNIT'S EXHAUST PORT TO THE HOSPITAL SCAVENGE SYSTEM. THE 1100 WILL RELEASE AGENTS INTO THE GENERAL ATMOSPHERE IF THE EXHAUST PORT IS NOT CONNECTED TO A SCAVENGE SYSTEM.

⚠ CAUTION ⚠

Read this manual entirely before attempting clinical use of the Criticare Systems, Inc. 1100 Patient Monitor.

⚠ CAUTION ⚠

Do not press on the keypad with surgical instruments or other tools. Use only your fingertips to press on the keys. Sharp or hard objects could damage the keypad.

⚠ CAUTION ⚠

Excessive amounts of motion at the sensor sites could cause errors in readings. Take new readings when motion has stopped or move sensor to another site.

General
(cont.)

⚠ CAUTION ⚠

Do not store equipment at extreme temperature. Storage temperature should be -5 to 50° C (23 to 122° F). Temperatures exceeding these limits could damage the system.

⚠ CAUTION ⚠

Equipment accuracy at extreme temperatures could be affected. For optimum performance, operating environment should have a room temperature of 15-40° C (59-104° F) and relative humidity 15-90% (non-condensing).

⚠ CAUTION ⚠

The internal rechargeable battery is a sealed lead acid type battery and it is totally maintenance free. If the battery becomes defective, refer to qualified service personnel.

⚠ CAUTION ⚠

Use care not to stretch internal probe and cable wires. Store probes and cables carefully after forming them into loose loops. If internal wires are stretched, mechanical failures could result.

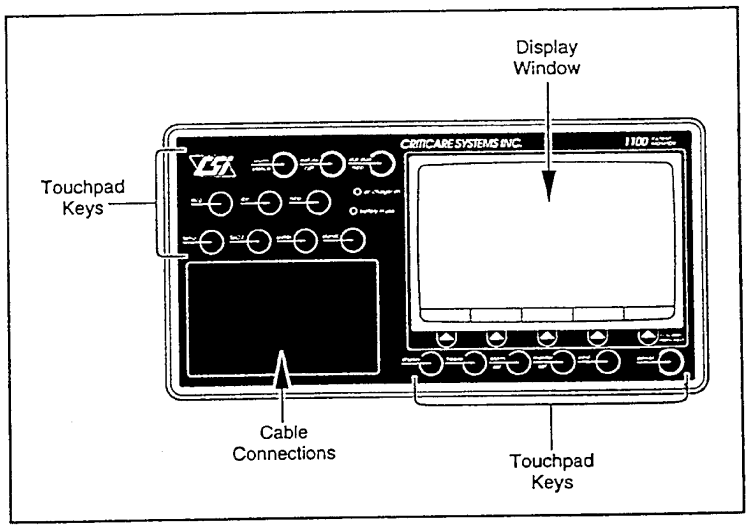
Section 2 -- Operator Controls

Section 2 — Operator Controls

This section provides an overview of the operator controls. It shows the location of and defines these controls. It explains each control's purpose and how to use it, and the principles behind the alarms selections. When to use the control and procedures for doing so are provided later in appropriate sections.

Front Panel

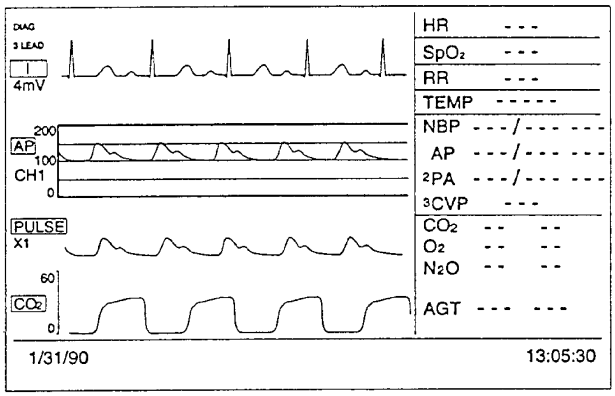
You'll find all operator controls on the front panel of the 1100 Patient Monitor. The front panel is made up of a display window, touchpad keys, a cable connection area, and two indicator LEDs.



Display Window

The display window responds to choices you make, system errors, anesthetic agents used, and alarms. The window shows:

- Measurements gathered by the 1100
- Status of each module
- Softkey labels



The display window ALWAYS shows system error messages, such as ALARM AUDIO OFF. These messages repeatedly flash at the bottom of the window. Each time an error message flashes, a beep is sounded.

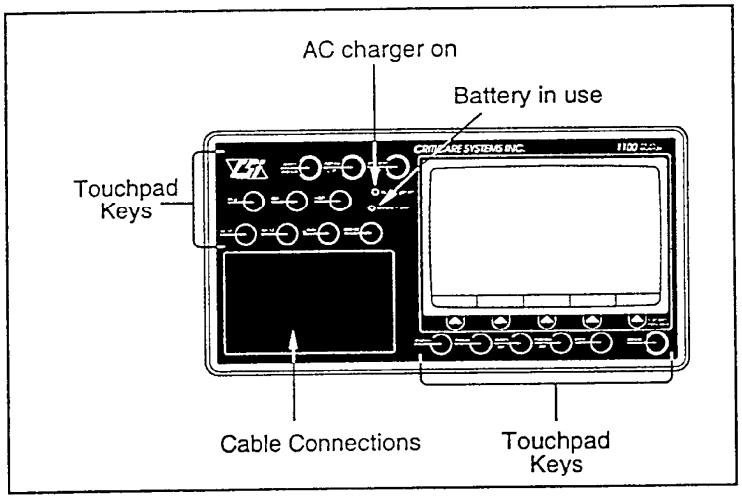
The 1100 recognizes the type of anesthetic agent being used and shows a three letter abbreviation for the agent name in place of the letters AGT in the lower right corner of the screen. If you use a mixed agent, an abbreviation shows for each agent present in the mix.

Touchpad Keys

⚠ CAUTION ⚠

Do not press on the keys with surgical instruments or other tools. Use only your fingertips to press on the keys. Sharp or hard objects could damage the keypad.

The touchpad keys are pressure sensitive. You press on the keys with your fingertips to make module selections, menu choices, and to set parameters. When you press and hold a key the 1100 continues to cycle through choices for that key. See **Section 4, Setting Parameters for Vital Signs**, and **Section 5, Viewing Patient Data,** for the procedures for making selections and setting parameters.



Cable Connections

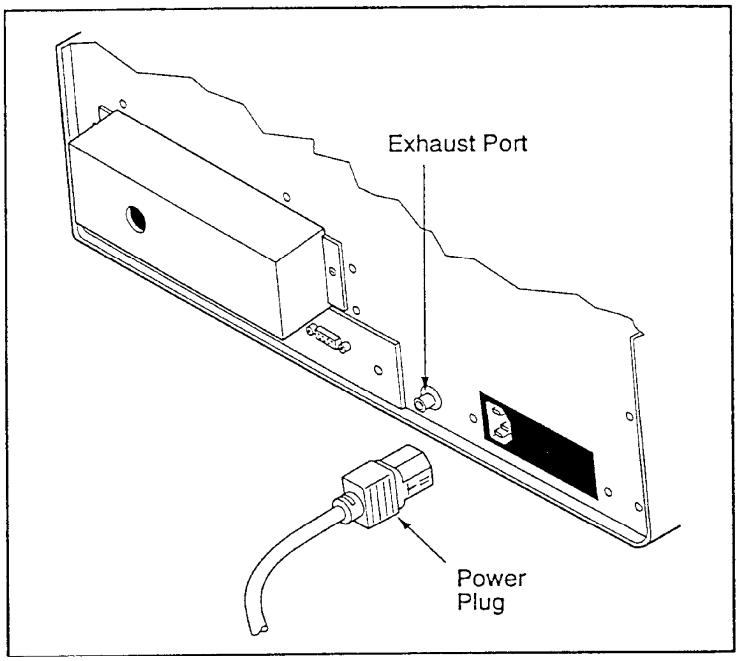
All cable and probe connections between the patient and the 1100 Patient Monitor are made at this location.

Battery Indicators

The two LEDs on the front panel light to indicate the battery status. Whenever the 1100 Patient Monitor is plugged into an electrical socket the battery is charging. The LOW BATTERY message shows at the bottom of the display when approximately 15 minutes of battery operation is available before recharge is necessary. The 1100 will operate for approximately 30 minutes on a fully charged battery. A completely discharged battery requires approximately 10 hours for full recharge.

Rear Panel

The power cord and exhaust connections are made at the rear of the monitor.



Power Cord

⚠ WARNING ⚠

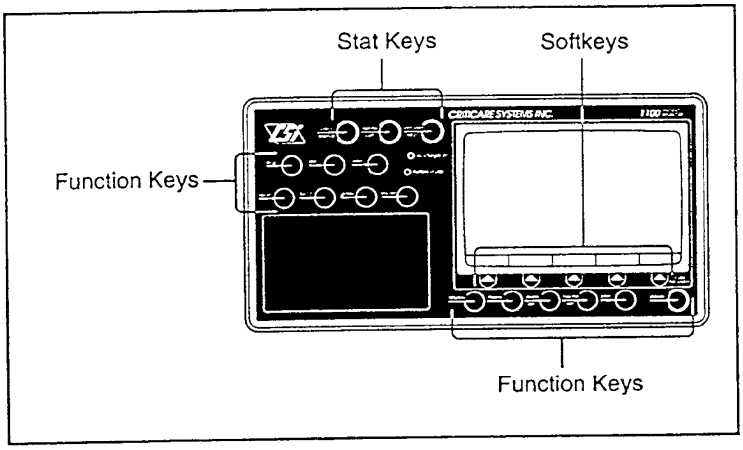
BE SURE THE POWER PLUG IS CONNECTED TO THE 1100 MONITOR BEFORE YOU PLUG THE CORD INTO AN ELECTRICAL OUTLET. USE HOSPITAL GRADE OUTLETS ONLY.

Exhaust Port

⚠ WARNING ⚠

DO NOT OPERATE THE 1100 WITH ANESTHETIC AGENTS WITHOUT FIRST CONNECTING THE UNIT'S EXHAUST PORT TO THE HOSPITAL SCAVENGE SYSTEM. THE 1100 WILL RELEASE AGENTS INTO THE GENERAL ATMOSPHERE IF THE EXHAUST PORT IS NOT CONNECTED TO A SCAVENGE SYSTEM.

Types of Touchpad Keys



There are four types of touchpad keys:

- Softkeys - keys that change function when other functions are selected
- Stat keys - immediately start or stop some action of the 1100 Patient Monitor
- Function keys - control the overall 1100 Patient Monitor systems

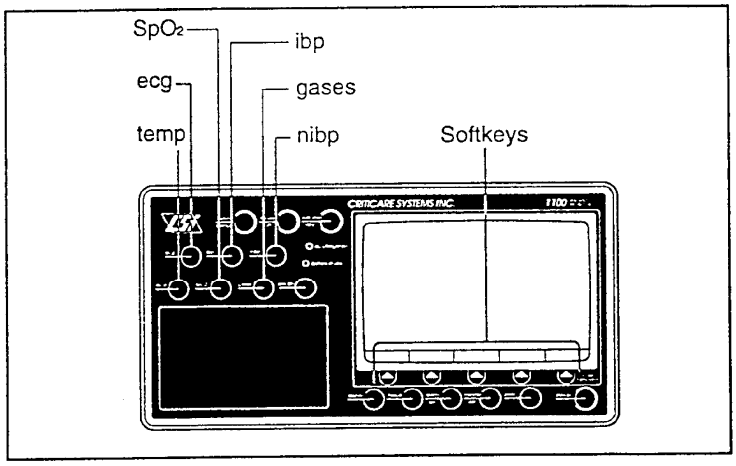
Softkeys

Softkeys are keys whose labels change depending on the function being set at the time. The key label describes the key's setting or function and shows in the window above the key.

When the softkey label describes a function, a single press of the softkey commands the 1100 to perform according to the label.

When the softkey label describes a setting, a single press of the softkey changes its setting to the next available choice. Press and hold a softkey when a setting is displayed and the 1100 cycles through all the settings available to you within that menu.

The softkeys show in the display window for 30 seconds. If you have not touched a softkey during that time, the 1100 returns to the display mode.



Function Keys

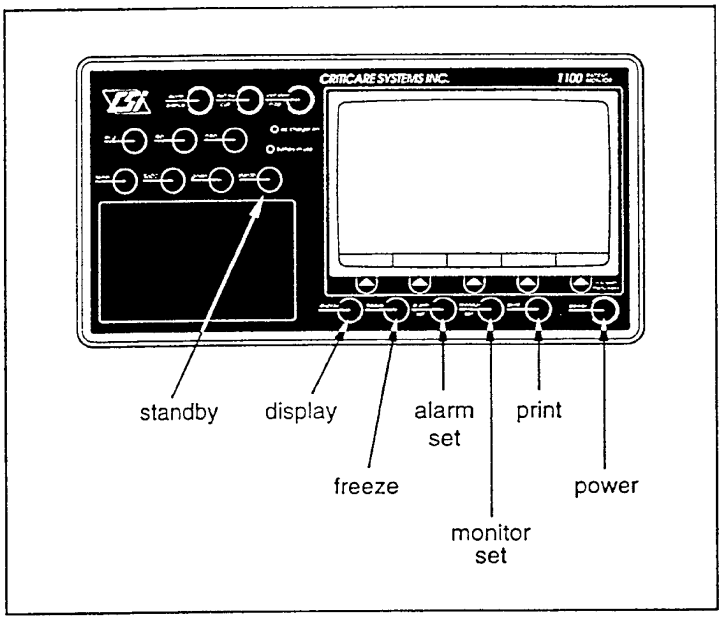
The ecg, ibp, nibp, temp, SpO_2, and gases keys each call up softkeys relating to their functions. The softkeys allow you to set patient-specific parameters for each of the vital signs modules. The procedures for using these keys and their related softkeys are described in **Section 4, Setting Parameters for Vital Signs.**

Stat Keys

The three stat keys, alarm silence, deflate cuff, and Stat/Start NIBP, each perform an immediate function whenever pressed. The following table shows the function of the stat keys:

When you press	The 1100
Alarm silence If the key is pressed: less than 1 second- between 1 and 2 seconds - greater than 2 seconds -	Turns off the alarm tone for two minutes or changes the alarm tone volume turns off alarm tone for 2 minutes. produces a tone at the current alarm volume. continuously cycles the alarm tone from off to maximum volume—release the button when the tone is at the desired volume.
Deflate cuff If the key is pressed: less than 1 second- greater than 1 second -	 Stops inflating the non-invasive blood pressure cuff. Stops inflating the cuff and turns off the NIBP function.
Stat/Start NIBP If the key is pressed: -less than 1 second - -greater than 1 second -	 Inflates the non-invasive blood pressure cuff and begins NIBP measurement. Initiates stat readings of NIBP. The unit will take continuous NIBP readings for 5 minutes or until the "deflate cuff" key is pressed.

Special Function Keys



POWER ON/OFF KEY

The power on/off key turns the system on or off. When the 1100 is turned off, some of the parameters set while it was on are retained in memory. The parameters saved when power is turned off are:

Module	Parameter
ECG	Sweep rate ECG filter ECG type ECG lead
IBP	CH1 scale CH1 type CH2 scale CH2 type CH3 scale CH3 type
NIBP	Cycle time
Temperature	Scale
Gas	Sweep rate CO_2 units CO_2 waveform

Special Function Keys (cont.)

Memory is erased when the monitor's backup battery is exhausted. Trend data is erased when the monitor is turned off.

When the monitor is off, it does not acknowledge key presses or perform any function. When the monitor is on, all functions are operable.

ALARM SET KEY

The alarm set key allows you to set alarms for:

- Heart rate, high and low
- Percent SpO_2, high and low
- Respiration rate, high and low
- Temperature - degrees F or C, high and low
- Systolic pressure, high and low
- Diastolic pressure, high and low
- Mean pressure, high and low
- Venous blood pressure, high and low
- Apnea - allowable seconds
- Asystole - allowable seconds
- CO_2 inspired and expired, high and low
- O_2 inspired and expired, high and low
- N_2O inspired and expired, high and low
- Agent inspired and expired, high and low

Setting the alarms is described in **Section 3, Setup Procedures.** You may choose one of three ways to arm these alarm settings:

- Smart Alarms
- Manual Alarms
- Default Alarms

Special Function Keys (cont.)

SMART ALARMS

Pressing the smart alarms softkey causes the 1100 to compute the high and low alarm settings for all the alarms based on the current patient baselines. The 1100 resets all alarm limits when this key is pressed. If the patient baseline is not available because a measurement mode is turned off, the alarm values are set to the alarm default values for that parameter.

MANUAL ALARMS

Pressing the manual alarms softkey causes the 1100 to show the manual alarms set menu. This menu lists all measurements that have alarm settings. You move through the list using the next and previous softkeys and change the alarms settings using the ▲ and ▼ keys.

DEFAULT ALARMS

The system initially powers up with the default values for all the alarm settings. Pressing the default alarms softkey causes the 1100 to restore all alarm settings to the default values.

FREEZE KEY

The freeze key allows you to freeze the waveforms shown in the display window. Press the key once, the waveforms freeze. Press the key again, the display resets and the waveforms update.

DISPLAY KEY

The display key allows you to choose how you want the 1100 to display patient data. There are four display modes:

- Four waveform
- Two waveform
- One waveform
- Trends

You'll find the four displays and the use of the display key menu explained in **Section 5, Viewing Patient Data.**

Special Function Keys (cont.)

MONITOR SET KEY

The monitor set key provides a menu which allows you to configure the system for the overall operation of the 1100 Patient Monitor. You set:

- Alarm volume
- System Error volume
- Heart Beat volume
- Where the waveform data shows on the screen
- Confidence mode
- Manual heart rate source
- Manual respiration rate source
- Analog Channels A, B, and C
- Strip chart recorder settings
- Date and time
- RS232 output
- Printer output

You'll find the procedure for using this key in **Section 3, Setup Procedures.**

PRINT KEY

The print key is used to start and stop the 1120 recorder and serial printer.

STANDBY KEY

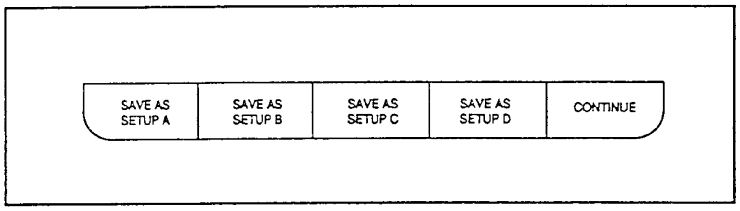
The standby key allows you to enter and exit standby mode. In standby mode all audible alarms are silenced and alarm limits are set to factory default values.

When you enter standby mode, NIBP is turned off. It may be restarted by pressing the "stat/start nibp" key.

Special Function Keys (cont.)

USER DEFINABLE SETUPS

When the monitor set key is pressed while the CSI logo is displayed upon power up, the following menu appears at the bottom of the first of the monitor set screens.



When the menu appears, press CONTINUE and proceed to set up the monitor as desired. Then press the alarm set key and set up alarms as desired, then press the display key and set the display as desired. Return to the monitor set screen and press SAVE AS SETUP A (or B, C, or D as desired). This procedure will store all of the settings in non-volatile memory. This procedure can be repeated for each setup (A, B, C, and D). Possible uses include different settings for different anesthesiologists or different settings for different types of cases. Once the power is turned off, the menu will change to USE SETUP (A, B, C, D). At this point, select the proper setting and adjust the physiologic alarm volume to start a case.

The current screen will then always appear as the first page when monitor set is pressed. When the User Definable Setup Menu appears, press SAVE AS SETUP A (or B, C, or D as desired) to store the setup in non-volatile RAM. All monitor setup parameters will then be stored, including:

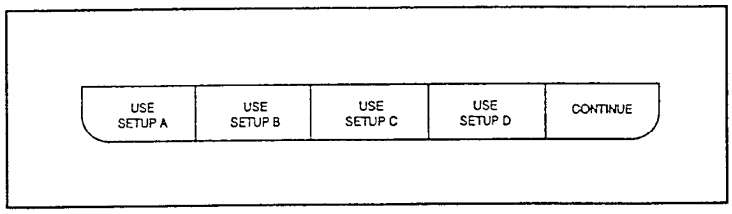
- the number of waveforms displayed
- alarm limits
- all alarm volumes *except* physiological alarm volume.

The physiological alarm volume defaults to 50% when the unit is powered up and when exiting standby.

Special Function Keys (cont.)

USING USER-DEFINABLE SETUPS

When the 1100 monitor is subsequently powered down and then powered up again, the first page of the monitor set screen will show the following menu:



Press CONTINUE to allow the user to proceed to what is now the first page of the monitor setup screen. The last two pages of the monitor setup screen will no longer be available to the user. This will prevent unauthorized changes of serial output formats.

Pressing any of the USE SETUP (A, B, C, or D) keys will set the monitor to the setup parameters stored in that particular memory. The initial values stored in all setups will be the current factory default settings.

Section 3 -- Setup Procedures

Section 3 — Setup Procedures

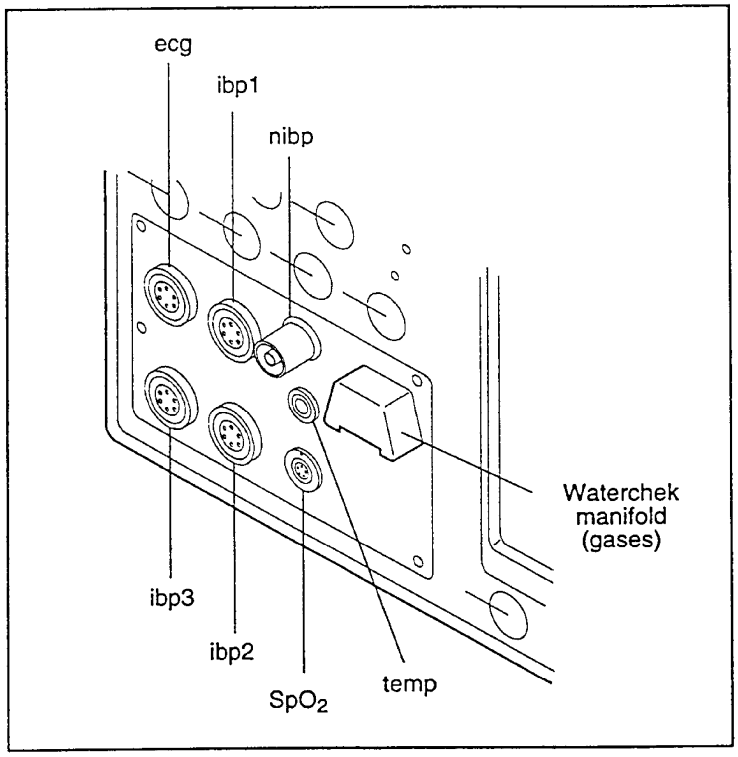
This section describes step-by-step procedures for making the 1100 Patient Monitor ready to operate. This section includes:

- Cable and probe connections
- Monitor configuration
- Alarms setup
- Calibration

Cable and Probe Connections

Front Panel Connections

Before turning on the monitor, attach cables and probes to the face of the monitor as indicated.



NOTE It is necessary to connect only those probes for the patient parameters you will measure.

NOTE If a patient parameter is not being measured, that parameter will turn off automatically, with the exception of ECG. See **Section 4 — Setting Parameters for Vital Signs.**

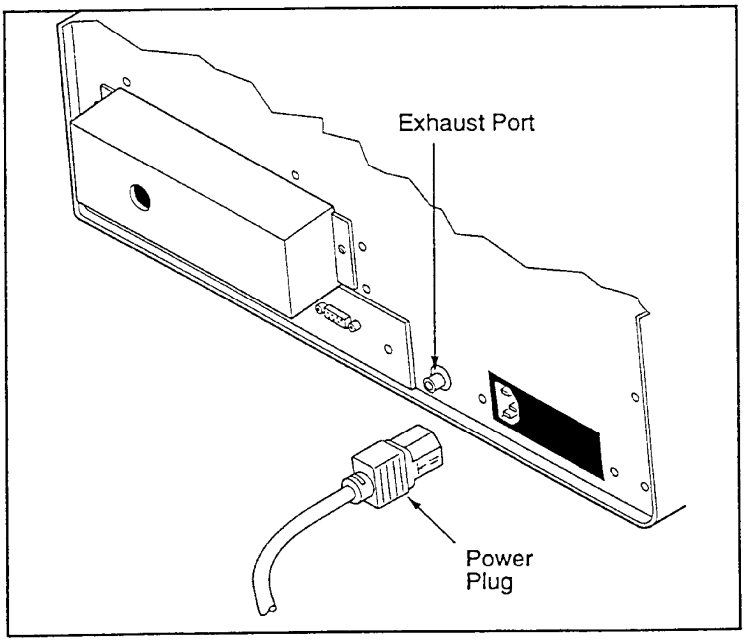
Exhaust and Power Connections

⚠ WARNING ⚠ **DO NOT OPERATE THE 1100 WITH ANESTHETIC AGENTS WITHOUT FIRST CONNECTING THE UNIT'S EXHAUST PORT TO THE HOSPITAL SCAVENGING SYSTEM. THE 1100 WILL RELEASE AGENTS INTO THE GENERAL ATMOSPHERE IF THE EXHAUST PORT IS NOT CONNECTED TO A SCAVENGE SYSTEM.**

⚠ WARNING ⚠ **BE SURE THE POWER PLUG IS CONNECTED TO THE 1100 MONITOR BEFORE YOU PLUG THE CORD INTO AN ELECTRICAL OUTLET. USE HOSPITAL GRADE OUTLETS ONLY. THIS UNIT IS APPROVED BY U.L. FOR USE WITH HOSPITAL GRADE OUTLETS.**

Connect the exhaust port at the rear of the monitor to the hospital scavenge system.

Plug the power cord in at the monitor. Plug the other end of the power cord into a hospital grade outlet.



ECG Setup

Before You Begin

The following special notices warn of avoidable conditions. Read and follow these warning notices to protect yourself and your patient.

⚠ WARNING ⚠

DO NOT USE MODEL 1100 PATIENT MONITOR FOR INTRACARDIAC ECG APPLICATION. USE MODEL 1100 PATIENT MONITOR ONLY AS RECOMMENDED BY THE MANUFACTURER. USING THE MODEL 1100 PATIENT MONITOR FOR INTRACARDIAC ECG APPLICATION COULD RESULT IN INJURY OR DEATH.

⚠ WARNING ⚠

USE THE 1100 PATIENT MONITOR ONLY WITH THE SUPPLIED CRITICARE ECG PATIENT CABLE AND LEADS. USE OF NON-APPROVED CABLES AND LEADS COULD CAUSE INJURY TO THE OPERATOR AND/OR PATIENT.

⚠ WARNING ⚠

THE CONDUCTIVE PARTS OF THE LEAD ELECTRODES AND ASSOCIATED CONNECTORS FOR TYPE CF ELECTROCARDIOGRAPHS, INCLUDING THE NEUTRAL ELECTRODE, SHOULD NOT COME IN CONTACT WITH OTHER CONDUCTIVE PARTS INCLUDING EARTH. SUCH CONTACT COULD RESULT IN PATIENT INJURY OR DEATH OR EQUIPMENT DAMAGE.

⚠ WARNING ⚠

ECG ELECTRODES COULD CAUSE SKIN IRRITATION. EXAMINE THE ECG ELECTRODE SITES DAILY FOR SKIN IRRITATION. CHANGE THE ELECTRODES AND REPOSITION EVERY 24 HOURS OR SOONER IF THERE IS ANY SIGN OF INFLAMMATION.

⚠ WARNING ⚠

DO NOT PLACE DEFIBRILLATOR PADDLES ON OR ADJACENT TO THE ECG PATIENT ELECTRODES. POSITION DEFIBRILLATOR PADDLES CLEAR OF THE ECG PATIENT ELECTRODES. CONTACT BETWEEN DEFIBRILLATOR PADDLES AND ECG PATIENT ELECTRODES COULD INJURE THE PATIENT.

Procedure for ECG Setup

1. Check the cables for fraying or other deterioration. Replace worn cables.
2. Attach the lead wires to the patient cable.
3. Attach the electrodes to the lead wires.

NOTE

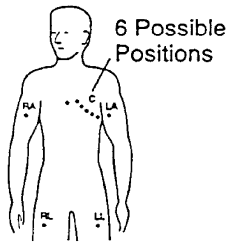
Criticare is not aware of any safety hazard due to the operation of a cardiac pacemaker or other electrical stimulators when used in conjunction with the Model 1100 Patient Monitor.

NOTE

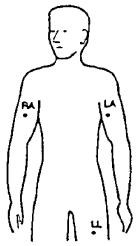
The ECG has been designed to be protected against the effects of cardiac defibrillator discharge.

4. Place the electrodes on the patient.
   - To remove natural skin oils, rub the patient's skin with gauze or a towel before applying the electrodes.
   - If the electrodes don't adhere well, apply benzoin to the area before applying the electrodes. Benzoin helps prevent skin breakdown and enhances electrode adhesion.
   - Check the lead wires and cables periodically for frays and cracks. Discard if frays or cracks are present.
   - Remove the electrodes once every 24 hours and examine the skin for irritation and breakdown. Apply clean electrodes to a different spot.
5. Using the ECG menu, select the lead configuration (3 or 5 leadwire) and the lead to supply the data for display. See **Section 4 - Setting Parameters for Vital Signs.**
6. Set gain option. See **Section 4 - Setting Parameters for Vital Signs.**

5 Leadwire Placement



3 Leadwire Placement



Pulse Oximeter Setup

Before You Begin

The following special notices warn or caution of avoidable conditions. Read and follow these warnings and cautions to protect yourself and your patient.

⚠ WARNING ⚠

PULSE OXIMETER SENSOR COULD CAUSE SKIN IRRITATION. INSPECT THE PULSE OXIMETER SENSOR SITE EVERY FOUR TO SIX HOURS. MOVE SENSOR TO A DIFFERENT LOCATION IF ANY SKIN IRRITATION IS PRESENT.

⚠ CAUTION ⚠

The pulse oximeter sensor is light sensitive. Too much ambient light makes it impossible for the system to provide accurate readings. The system provides a high ambient light alarm when it is necessary to shield the sensor from extraneous light sources such as phototherapy light or infrared heating lamps.

⚠ CAUTION ⚠

Do not tape over the pulse oximeter sensor housing. Taping over the housing could cause injury and sensor failure due to too much pressure. If the sensor needs to be secured, place tape over the cable, immediately behind the sensor.

⚠ CAUTION ⚠

Do not place the pulse oximeter sensor on the same extremity with the blood pressure cuff or an arterial line. Place the pulse oximeter sensor on the side of the patient opposite the blood pressure cuff or an arterial line. The occlusion of the blood flow during blood pressure determinations could affect saturation readings.

⚠ CAUTION ⚠

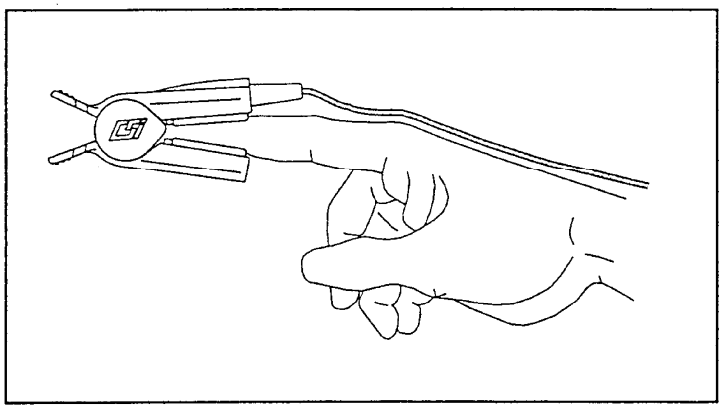
Use care not to stretch internal cable wires. Store cable carefully after forming it into a loose loop. If internal wires are stretched, mechanical failures could result.

Procedure for Pulse Oximeter Setup

1. Attach the finger sensor to the monitor.
2. Place the finger sensor on the patient's finger, as shown.

Note

If using a Multi-Site™ or disposable sensor: if the sensor is not properly attached, the pulse oximeter waveform will disappear from the 1100 monitor. Check the sensor for proper application.



Non-Invasive Blood Pressure Setup

Before You Begin

The following special notices caution of avoidable conditions. Read and follow these cautions to protect yourself and your patient.

⚠ CAUTION ⚠ Use a BP cuff that fits the patient. Accuracy of blood pressure readings depends on using a properly sized cuff.

⚠ CAUTION ⚠ The blood pressure cuff itself can be a major source of inaccurate indirect blood pressure measurements. The size of the cuff has a major impact on the accuracy of the results. Accurate results will be obtained if the width of the cuff is >1/3 the circumference of the arm. A cuff that is too narrow results in falsely high pressure readings. A cuff that is too wide results in falsely low pressure reading.

⚠ CAUTION ⚠ If a patient experiences a sudden dramatic drop in blood pressure, the system may not detect the pressure on the first attempt. The system will detect the change on the second attempt.

⚠ CAUTION ⚠ The accuracy of non-invasive blood pressure readings may be adversely affected by the presence of agents which alter the patient's cardiovascular dynamics.

⚠ CAUTION ⚠ The sensitivity of invasive and non-invasive blood pressure monitoring may be affected when used on patients with intra-aortic balloon pumps.

⚠ CAUTION ⚠ Interference or errors in readings may be caused by the presence of electrocautery or diathermy interference.

Procedure for NIBP Setup

1. Select the proper size cuff for the patient's extremity.
2. Connect the BP cuff to the 1100 monitor.
3. Secure the cuff around the patient's extremity.
4. Make sure there are no kinks in the hose extending from the cuff.

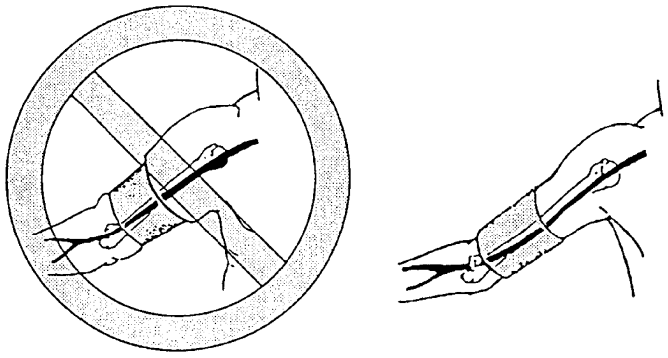
Non-invasive Blood Pressure (NIBP)

Blood Pressure can be taken on demand or automatically. Before taking a blood pressure reading, be sure that the cuff is the correct size.

Selecting a BP Cuff

Proper cuff size and placement is essential to assure accurate blood pressure measurement. The American Heart Association recommends cuff sizes should be at a ratio of about 2:1, so that if the cuff width is 40% of arm circumference, the cuff bladder length will encircle 80% of the arm. Also, care should be taken to center the bladder directly over the brachial artery.

Refer to the following illustration. The cuff shown on the left is too small for the arm, therefore, full cuff pressure is never applied to the artery. This causes an erroneously high blood pressure reading. The cuff shown on the right is of adequate width for the arm, and full cuff pressure is applied to the brachial artery.



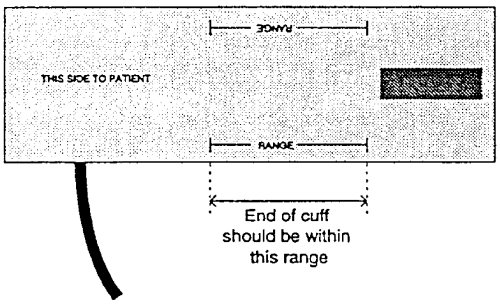
WRONG **RIGHT**

Cuffs for thighs are available for large patients or those where neither arm is available for cuff placement. Blood pressure measured at the thigh is typically 20-30 mmHg higher than blood pressure measured at the upper arm.

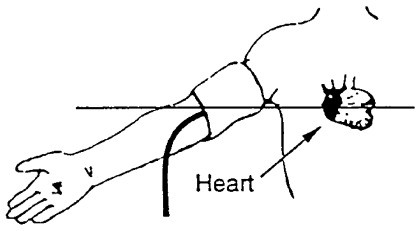
Placing the NIBP Cuff

Wrap the cuff snugly around the extremity, leaving enough room between the cuff and the extremity for two fingers. If the cuff is too loose, it cannot be inflated properly and may cause errors in measured BP values. Observe the following precautions:

- It is best to wrap a bare extremity; putting the cuff over clothing may cause errors in measured values.
- The end of the cuff should fall inside the range marked clearly on the inside of the cuff. If not, use a different size cuff. (Refer to the following illustration.)

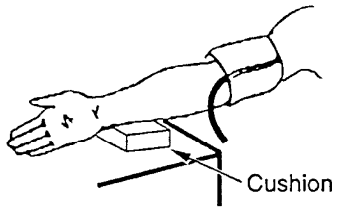


- The hose should be placed directly over the brachial artery and should not be twisted or kinked.
- Keep the cuffed part of the arm at the same level as the heart. BP measurement points above the level of the heart will give reduced pressure values. Measurement points below the heart level will give increased values. These errors are due to the weight of the blood. (Refer to the following illustration.)



Placing the NIBP Cuff (cont.)

- Do not compress the cuff or the rubber hose externally. Compression of the cuff or the rubber hose will cause measurement error. Rest the arm on a cushion to prevent compression against the body. (Refer to the following illustration.)



- The patient should remain still during blood pressure measurement.

NOTE

When using cuffs sized for neonates*, place the monitor in the neonatal mode.

- Select the correct mode (NEO or ADULT) from the Configuration Screen.

See **Section 4, Setting Parameters for Vital Signs,** for additional information.

* Catalog Nos. 665, 666, 667, 668, 669, 672, and 673 are neonate cuffs.

Temperature

Before You Begin

The following special notices warn or caution of avoidable conditions. Read and follow these warnings and cautions to protect yourself and your patient.

⚠ WARNING ⚠

USE A SANITARY TEMPERATURE PROBE FOR EACH PATIENT. IF A CLEAN, SANITARY TEMPERATURE PROBE IS NOT USED FOR EACH PATIENT, DISEASES COULD BE TRANSMITTED.

⚠ CAUTION ⚠

Use care not to stretch internal temperature probe and cable wires. Store probes and cables carefully after forming them into loose loops. If internal wires are stretched, mechanical failures could result.

Procedure for Temperature Setup

1. Connect the temperature probe to the monitor.
2. Attach the probe to the patient according to the probe instructions.

Monitor Parameters

Purpose of Monitor Set Menu

You configure the monitor operation at the monitor set menu. The following table shows the various parameters affected, their possible settings (defaults are in bold type), and the purpose of each parameter:

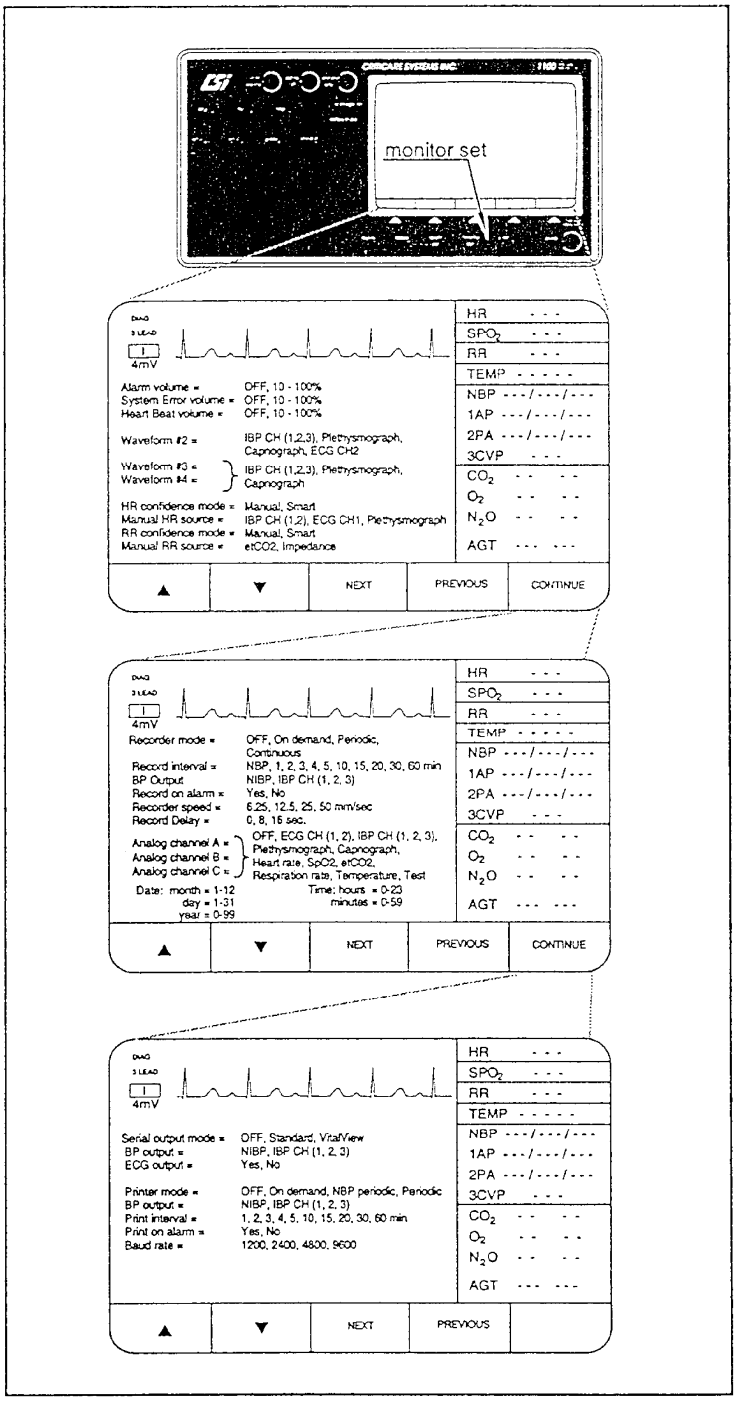
Parameter	Settings	Purpose
Alarm volume	off, 10-100% default is 50%	Adjust the volume at which alarms sound, expressed as a percent of the maximum volume.
System error volume	off, 10-100% default is 50%	Adjust the volume at which the monitor will warn of system errors, as a percent of the maximum volume.
Heartbeat volume	off, 10-100% default is 50%	Adjust the volume at which the monitor will signal heartbeats, as a percent of the maximum volume.
Waveforms Defaults: #2 **IBP1** #3 **Plethysmograph** #4 **Capnograph**	IBP Ch1, IBP Ch2, Capnograph, Plethysmograph (also, ECG Ch2 for Waveform #2 only)	Set where you want the waveforms to display.
Heart rate confidence mode	**smart**, manual	Toggle the precedences for module input.
Manual heart rate source	**ECG**, SpO_2 pulse, IBP Ch1, IBP, Ch2	Choose the data source for the heartbeat display.
Respiration rate confidence mode	smart, **manual**	Toggle the precedences for module input.
Manual respiration rate source	**$etCO_2$**, Impedance	Choose the data source for the respiration rate display.
Recorder mode	On Demand, Periodic, Continuous	Selects the output to the 1120 strip chart recorder.
BP output	NIBP, IBP (Ch1, Ch2, Ch3)	Selects the BP output to the 1120 strip chart recorder
Record delay	0, 8, 16 sec.	Sets the amount of waveform printed prior to alarm activation or manual request.
Record interval	NBP, 1, 2, 3, 4, 5, 10, 15, 20, 30, 60 min.	When in Periodic mode, sets the interval at which the 1120 strip chart recorder prints.
Record on alarm	Yes, No	When set to Yes, prints a strip chart whenever a patient alarm activates.

Record Speed	6.25, 12.5, 25, 50 mm/sec	Sets the paper speed for the 1120 strip chart recorder.
Analog channels 1, 2, 3 Defaults: **#1 ECG Ch1** **#2 Plethysmograph** **#3 Capnograph**	off Waveforms: Test, Capnograph, Plethysmograph IBP Ch1, IBP Ch2, ECG Trends: Temperature, Respiration rate, $etCO_2$, SpO_2, Heart Rate	Set channels used by external devices, computers, printers.
Date: Month Day	 1-12 1-31	Set to current date.
Time: Hour 0-23 Minute	 0-59	Set to current time.
Serial output mode	Off, Standard, VitalView	Sets the format for the serial output.
BP output	NIBP, IBP, CH (1, 2, 3)	Selects which blood pressure is output when in VitalView serial output mode.
ECG output	Yes, No	Turns the ECG output to the serial printer on or off.
Printer mode	**On Demand**, Continuous,	Set the condition for strip Periodic, NBP Periodic chart to print
Print interval	1, 2, 3, 4, 5, 10, 15, 20, 30, 60 minutes	Set the time between prints. Used with Periodic print mode.
Print on alarm	**Yes**, no a patient alarm activates	Print a strip chart whenever
Baud rate	1200, 2400, 4800, 9600	Sets a baud rate for output to the serial printer.
Agent set	Hal/Enf/Iso, Hal/Sev/Iso	Selects agents monitored.

Procedure for Setting Monitor

1. Press the monitor set key, The monitor set menu appears on the screen in place of the waveforms. The ECG waveform remains active during the monitor setting procedure.
2. Using the NEXT and PREVIOUS softkeys move the cursor until you have highlighted the parameter you want to change.

   The monitor met menu has three screens. If the parameter you want to change does not appear on the first screen, press the CONTINUE softkey to move to the second or third screen.
3. Press the ▲ and ▼ softkeys until the option you want for the highlighted parameter shows.
4. When you have finished making your selections, press the display key to return to the waveforms display.


monitor set
DIAG
3 LEAD
I
4mV
Alarm volume = OFF, 10 - 100%
System Error volume = OFF, 10 - 100%
Heart Beat volume = OFF, 10 - 100%
Waveform #2 = IBP CH (1,2,3), Plethysmograph, Capnograph, ECG CH2
Waveform #3 = IBP CH (1,2,3), Plethysmograph, Capnograph
Waveform #4 = IBP CH (1,2,3), Plethysmograph, Capnograph
HR confidence mode = Manual, Smart
Manual HR source = IBP CH (1,2), ECG CH1, Plethysmograph
RR confidence mode = Manual, Smart
Manual RR source = etCO2, Impedance
HR - - -
SPO2 - - -
RR - - -
TEMP - - - - -
NBP - - - / - - - / - - -
1AP - - - / - - - / - - -
2PA - - - / - - - / - - -
3CVP - - -
CO2 - - - -
O2 - - - -
N2O - - - -
AGT - - - - - -
▲
▼
NEXT
PREVIOUS
CONTINUE
DIAG
3 LEAD
I
4mV
Recorder mode = OFF, On demand, Periodic, Continuous
Record interval = NBP, 1, 2, 3, 4, 5, 10, 15, 20, 30, 60 min
BP Output NIBP, IBP CH (1, 2, 3)
Record on alarm = Yes, No
Recorder speed = 6.25, 12.5, 25, 50 mm/sec
Record Delay = 0, 8, 16 sec.
Analog channel A = OFF, ECG CH (1, 2), IBP CH (1, 2, 3), Plethysmograph, Capnograph, Heart rate, SpO2, etCO2, Respiration rate, Temperature, Test
Analog channel B =
Analog channel C =
Date: month = 1-12
day = 1-31
year = 0-99
Time: hours = 0-23
minutes = 0-59
HR - - -
SPO2 - - -
RR - - -
TEMP - - - - -
NBP - - - / - - - / - - -
1AP - - - / - - - / - - -
2PA - - - / - - - / - - -
3CVP - - -
CO2 - - - -
O2 - - - -
N2O - - - -
AGT - - - - - -
▲
▼
NEXT
PREVIOUS
CONTINUE
DIAG
3 LEAD
I
4mV
Serial output mode = OFF, Standard, VitalView
BP output = NIBP, IBP CH (1, 2, 3)
ECG output = Yes, No
Printer mode = OFF, On demand, NBP periodic, Periodic
BP output = NIBP, IBP CH (1, 2, 3)
Print interval = 1, 2, 3, 4, 5, 10, 15, 20, 30, 60 min
Print on alarm = Yes, No
Baud rate = 1200, 2400, 4800, 9600
HR - - -
SPO2 - - -
RR - - -
TEMP - - - - -
NBP - - - / - - - / - - -
1AP - - - / - - - / - - -
2PA - - - / - - - / - - -
3CVP - - -
CO2 - - - -
O2 - - - -
N2O - - - -
AGT - - - - - -
▲
▼
NEXT
PREVIOUS

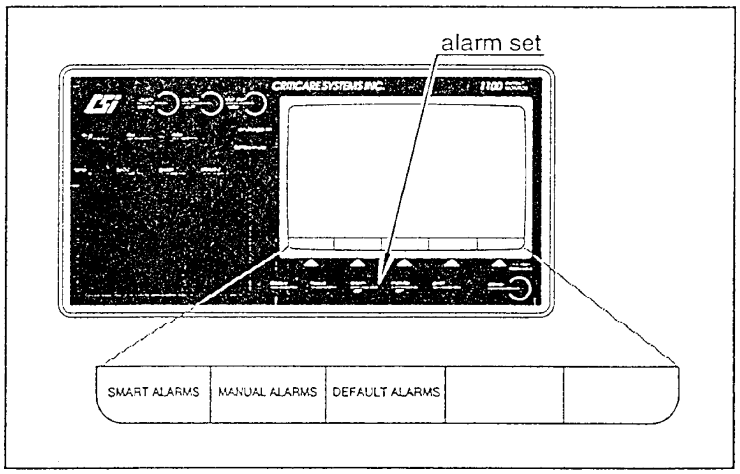
Alarm Setup

Choosing the Alarm Type

With the 1100 Patient Monitor, you set the limits for alarms. To set alarm limits, press the alarm set key.

The softkeys change to the alarm setup mode as shown. You choose one of the three types of alarms settings:

- Smart Alarms
- Manual Alarms
- Default Alarms



Press this key	To set this alarm type
SMART ALARMS	1100 computes limits from patient's baselines
MANUAL ALARMS	Manually determined alarm limits -- Manual Alarms Set screen appears
DEFAULT ALARMS	Factory preprogrammed alarm limits are activated

Setting Smart Alarms

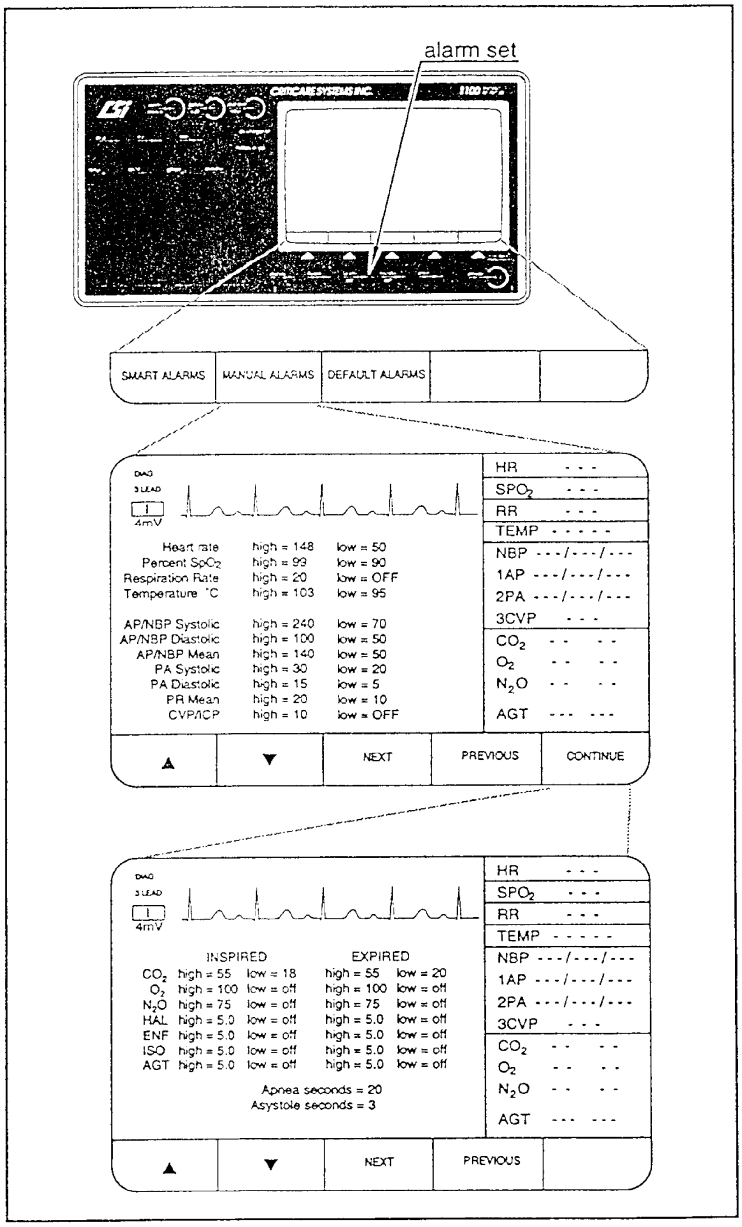
Pressing the SMART ALARMS softkey causes the 1100 to compute alarm settings based on current patient baselines. If the patient baseline is not available the alarm values remain unchanged.

Where more than one blood pressure channel is set to use the same alarm, the baseline used to set the alarm will come from channel 1, channel 2, channel 3 or NIBP, in that order. For example, if channel 2 is set to CVP, and channel 3 is set to ICP, they are using the same alarm, and the channel 2 baseline will be used to calculate the alarm value. Smart alarm specifications are as follows:

Alarm	Alarm Limits	
· Heart rate	<90 bpm	+/-10 bpm
	90 - 139 bpm	+/-15 bpm
	>140 bpm	+/- 20 bpm
· Percent SpO_2	<=80%	+/-2%
	>80%	+/-3%
· Respiration rate	+/-10 breaths/min	
· Temperature	+/-1.7 deg C	
	+/-3.0 deg F	
· AP/NIBP Systolic	>140mm Hg	+/-30mm Hg
	101-140mm Hg	+/-20mmHg
	<=100mm Hg	+/-15mm Hg
· AP/NIBP Diastolic	+/-10mmHg	
· AP/NIBP Mean	+/-20mm Hg	
· PA Systolic	>140mm Hg	+/-30mm Hg
	101-140mm Hg	+/-20mm Hg
	<=100mm Hg	+/-15mm Hg
· PA Diastolic	+/-5mm Hg	
· PA Mean	+/-5mm Hg	
· CVP/ICP	+/-5mm Hg	
· $etCO_2$	<=40mm Hg	+/-5mm Hg
	>40mm Hg	+/-8mm Hg
	<=5.5kPa	+/-0.7kPa
	>5.5kPa	+/-1.1kPa

Setting Manual Alarms

Pressing the MANUAL ALARMS softkey causes the 1100 to show the Manual Alarms Set menu. This menu lists all measurements which have alarm settings. You move through the list using the NEXT and PREVIOUS softkeys and change the alarm settings using the ▲ and ▼ keys.



Setting Manual Alarms (cont.)

To set manual alarms limits:

1. Use the NEXT and PREVIOUS softkeys to move to the parameter you want to change.
2. Use the ▲ and ▼ keys to increase or decrease the parameter value.
3. When you have finished setting the alarm limits, press the display key to return to the waveforms display

The following table shows choices for the manual alarms limits:

Parameter	High	Low
Heart rate	80-240, off	off, 20-100
Percent SpO_2	80-99, off	off, 70-95
Temperature °F	84-108, off	off, 84-108
Temperature °C	28.9-42.2, off	off, 28.9-42.1
Respiration rate	20-90, off	off, 1-20
AP/NIBP Systolic	130-240, off	off, 40-120
AP/NIBP Diastolic	80-240, off	off, 20-120
AP/NIBP Mean	80-250, off	off, 25-90
PA Systolic	15-75, off	off, 1-25
PA Diastolic	5-50, off	off, 1-15
PA Mean	5-40, off	off, 1-20
CVP	5-20, off	off, 1-10
Apnea	n/a	10-60, off
Asystole	n/a	3-20, off
Inspired CO_2	n/a	0-24, off
Expired CO_2	21-99, off	off, 0-76
Inspired O_2	19-100, off	18-100
Expired O_2	0-100, off	off, 1-100
Inspired N_2O	0-80, off	off, 1-79
Expired N_2O	0-80, off	off, 1-79
Inspired Hal	0-5.0	off, 0.1-4.9
Expired Hal	0-5.0	off, 0.1-4.9
Inspired Enf	0-5.0	off, 0.1-4.9
Expired Enf	0-5.0	off, 0.1-4.9
Inspired Iso	0-5.0	off, 0.1-4.9
Expired Iso	0-5.0	off, 0.1-4.9
Inspired Sev (opt.)	0-9.0	off, 0.1-8.9
Expired Sev (opt.)	0-9.0	off, 0.1-8.9
Without Sev:		
Inspired Agent	0-5.0	off, 0.1-4.9
Expired Agent	0-5.0	off, 0.1-4.9
With Sev:		
Inspired Agent	0-9.0	off, 0.1-8.9
Expired Agent	0-9.0	off, 0.1-8.9

Setting Default Alarms

The system initially powers up with the default values for all alarms settings. Pressing the default alarms softkey causes the 1100 to restore all alarms settings to the default values.

The following table shows the adult default alarms limits:

Parameter	High	Low
Heart rate	180	40
Percent SpO_2	off	90
Temperature	100°F/37.8°C	93°F/33.9°C
Respiration rate	35	2
AP/NIBP Systolic	200	50
AP/NIBP Diastolic	100	30
AP/NIBP Mean	150	50
PA Systolic	40	15
PA Diastolic	15	5
PA Mean	20	10
CVP/ICP	15	1
Apnea	n/a	20 seconds
Asystole	n/a	20 seconds
Minimum inspired CO_2	5	n/a
Expired CO_2	55	20
Inspired O_2	100	18
Expired O_2	100	off
Inspired NO_2	75	off
Expired NO_2	75	off
Inspired Hal	5.0	off
Expired Hal	5.0	off
Inspired Enf	5.0	off
Expired Enf	5.0	off
Inspired Iso	5.0	off
Expired Iso	5.0	off
Inspired Sev (opt.)	9.0	off
Expired Sev (opt.)	9.0	off
Without Sev:		
Inspired Agent	5.0	off
Expired Agent	5.0	off
With Sev:		
Inspired Agent	9.0	off
Expired Agent	9.0	off

Setting User-Definable Setup

The user-definable setup feature allows the user to define their own default values. For information on this feature, see **Section 2 -- Operator Controls.**

Calibration

The following special notices warn or caution you about avoidable conditions. Read these warnings and cautions to protect yourself and your patient.

Before You Begin

⚠ WARNING ⚠

DO NOT DISPOSE OF THE O_2 CARTRIDGE WHERE IT MAY BE INCINERATED. O_2 CARTRIDGE CONTAINS CAUSTIC MATERIAL. DISPOSE OF THIS CARTRIDGE IN ACCORDANCE WITH HOSPITAL REQUIREMENTS FOR CAUSTIC MATERIALS DISPOSAL.

⚠ CAUTION ⚠

After any calibration, check the calibration accuracy by running another known gas mixture through the monitor. This cross-check provides data required to verify that the monitor is calibrated properly.

⚠ CAUTION ⚠

Change the Water Chek™ and sample line for the $etCO_2$ every 24 hours or when it is 3/4 full. The sample line must be changed before it becomes totally occluded.

The calibration kit provided by CSI (Cat. No. 630) contains three aerosol gas cylinders:

Cylinder	$\%CO_2$	$\%N_2O$	%Agent
1	5%	60%	1% Isoflurane
2	5%	60%	1% Enflurane
3	5%	60%	1% Halothane

The remainder of the gas in the cylinders is N_2.

Use these gases for this procedure. For Sevoflurane calibration gas, contact your Criticare sales representative, or use 2.0 volume percent Sevoflurane, balance nitrogen, with an analyzed tolerance of ±2% relative (±0.04 volume percent).

Calibration (cont.)

At room temperature, the 1100 Patient Monitor requires a five minute warm up before calibration may begin. The temperature of the monitor must be between 15 and 40° C (59-104° F) prior to attempting to calibrate gases. It the monitor is extremely cold, allow a 30 minute warm up before calibrating.

A Water Chek™ and sample line must be in place before you begin the calibration. Install a Water Chek™ and sample line, if these are not already in place on the 1100.

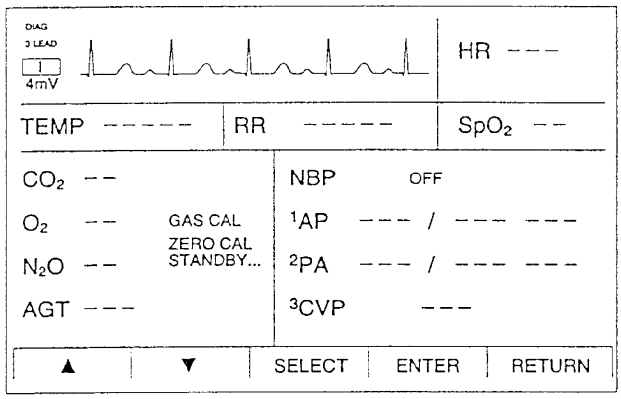
Frequency

Perform gas calibration every month to obtain optimal accuracy. This calibration should only be performed by qualified personnel.

Procedure for Gas Calibration by User

Use the following procedure to calibrate the 1100 Patient Monitor to known gases.

1. Press the gases key. The gases softkeys appear at the bottom of the screen.
2. Press the CALIBRATE softkey. The following screen appears and shows the message ZERO CAL STANDBY...

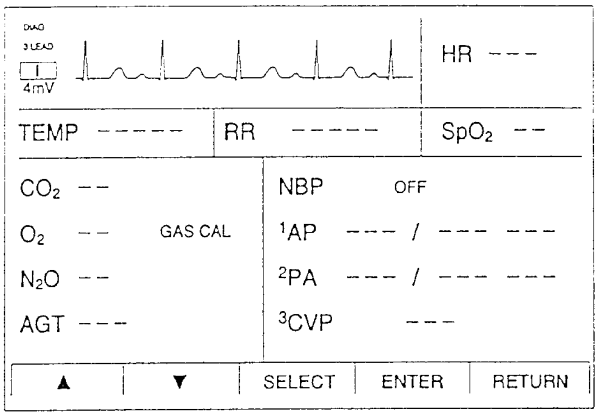


The zero calibration lasts approximately one minute. During this time, the 1100 autozeros CO_2, N_2O and anesthetic agents, and calibrates oxygen at 21%.

Procedure for Gas Calibration by User (cont.)

You are not required to calibrate oxygen. The 1100 performs auto calibration of oxygen measurement each time the monitor is turned on and at regular intervals during monitoring.

When the 1100 completes zero calibration, it shows the following screen:



3. Using the connection tubing in the gas cylinder cap connect the Water Chek™ sample line to the calibration gas cylinder.
4. Allow the calibration gas to flow. The 1100 recognizes the type of anesthetic agent in the gas and shows the abbreviated name for the gas in the window in place of AGT. While the gas flows, watch for the readings to stabilize for at least five seconds.
5. Compare the stabilized readings with the aerosol gas cylinder label.

   Do the readings match?
   - -- If yes, press the ENTER softkey to send the information to the capnograph.
   - -- If no, press the SELECT softkey to highlight the non-matching value. Press the ▲ and ▼ keys to increase or decrease the value to match the cylinder label. Press ENTER.
6. Repeat step 5 until all gas values shown on the screen match the cylinder label.
7. Repeat the calibration using the remaining cylinders in the kit. Since the gas mixtures differ only by the anesthetic agent, you'll need only to adjust the anesthetic agent value.
8. Press the display key to return to the display mode.

Anesthetic Agent Identification and Quantification

The 1100 monitor is an agent-specific monitor, which means that it is capable of simultaneously distinguishing between and quantifying various halogenated anesthetic agents (specifically, isoflurane [ISO], halothane [HAL], or enflurane [ENF]).

The anesthetic agent concentrations reported by the 1100 monitor are not affected by the presence of ethyl alcohol (as in the case of intoxicated trauma patients), or metabolic ketones (as in the case of diabetic patients with ketoacidosis).

Mixed Anesthetic Agents

If more than one agent is detected, the flashing MIX label will replace the previous label, and an audio alarm will sound (this is considered a system alarm).

During a mix condition, the numeric screen displays both inspired and expired concentrations for H, E, and I

The criteria used by the 1100 monitor to identify an agent mix is that the second agent must be detected in a concentration of 0.3 volume percent, or 20% of the primary component (whichever is greater).

⚠ WARNING ⚠

IF ANY HALOGENATED ANESTHETIC AGENT OTHER THAN ISOFLURANE, HALOTHANE, OR ENFLURANE IS PRESENT, IT WILL BE MISIDENTIFIED AND/OR WILL INTERFERE WITH THE REPORTED ANESTHETIC AGENT CONCENTRATION(S).

Anesthetic Agent Identification and Quantification (cont.)

Sevoflurane Units Only

The AGENT SET selection will appear in the third monitor screen, and can be set to either HAL/ENF/ISO or HAL/SEV/ISO. The agent set determines which set of three anesthetic agents the 1100 monitor is capable of monitoring at any given time. If this setting is selected to HAL/SEV/ISO, all references to enflurane in this section are replaced with sevoflurane.

⚠ WARNING ⚠

IF ANY HALOGENATED ANESTHETIC AGENT OTHER THAN THE THREE SPECIFIED IN THE "AGENT SET" CHOICE IN THE SETUP SCREEN IS PRESENT, IT WILL BE MISIDENTIFIED AND/OR WILL INTERFERE WITH THE REPORTED ANESTHETIC AGENT CONCENTRATION(S).

Section 4 -- Setting Parameters for Vital Signs

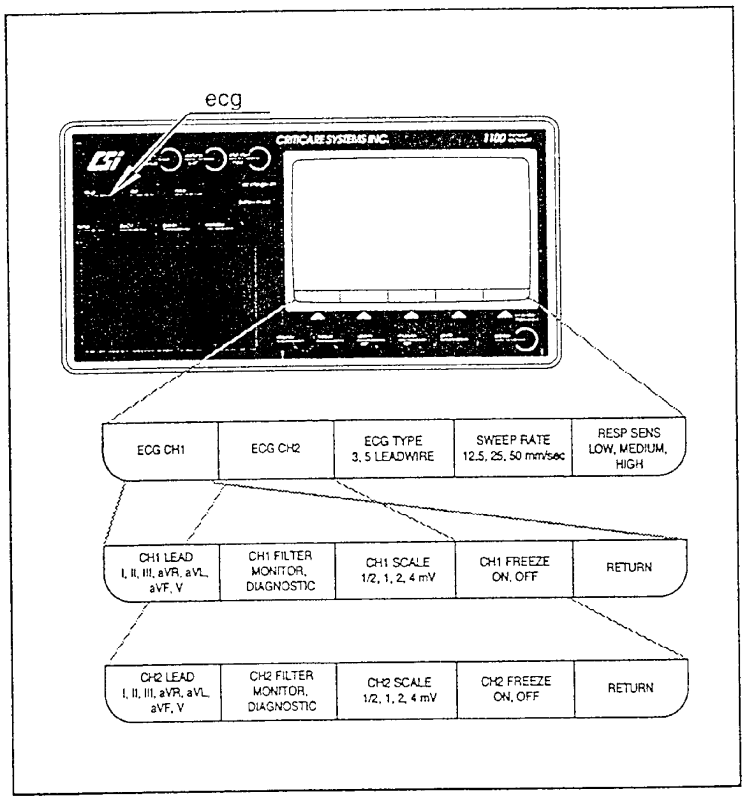
Section 4 — Setting Parameters for Vital Signs

This section covers the key sequences for setting the 1100 Patient Monitor to read various parameters and explains how the 1100 determines which module will measure any particular patient vital sign.

ECG

ECG Setup Keys

Pressing the ecg key brings up a set of ECG-specific softkeys. The parameters currently in effect for the softkeys show in the softkey windows. To change a parameter, press the softkey labeled for that parameter.



ECG Setup Keys (cont.)

Using the softkeys, you can:

- Change the lead configuration between 3 leadwire and 5 leadwire
- Determine which lead provides the signal for the ECG waveform preferred
- Switch the ECG filter between monitor and diagnostic mode
- Freeze a channel of the ECG waveform if multiple waveforms are displayed on the monitor

NOTE The sweep rate setting for the ECG waveform affects the IBP and pulse waveforms as well.

NOTE The heart rate and respiration rate may continue to display if another module which measures them is on. See **Precedence of Module Input** in this section for details.

To change a parameter:

1. Press the ecg key.
2. Press the softkey for the parameter you want to change, until the setting you want for that parameter appears in the softkey window. (The sequence of menu screens is shown on page 4-1.)
3. When you are finished changing ECG parameters, press the display key to return to viewing patient data. If no key is pressed, the screen returns to the patient data display after 30 seconds.

ECG Alarms

If any of the electrodes are disconnected from the patient, or the cable is disconnected from the monitor, a system error alarm sounds and the unit designates the disconnected electrode.

If any of the parameter alarms are activated, pressing the alarm silence key will stop the sound for two minutes. See **Section 3, Setup Procedures** for information on setting manual alarm limits.

ECG Default Settings

Parameter	Default Setting
Scale	1 mV
Filter	Monitor
Sweep rate	25 mm/sec
ECG lead	II
ECG type	3 leadwire

Freezing ECG Channels

It is possible to freeze either of the ECG channels on the 1100 monitor. This capability is provided so that a real-time waveform can be compared to a waveform which was stored at the beginning of a case. Both ECG waveforms must be available before the freeze function will work. When switching to a screen which only displays the waveform (such as the Tabular Trend screen or Single Waveform screen), the single waveform will become a real-time waveform until the unit is switched back to a mode which displays more than one waveform. At that time, the frozen waveform will again reappear. Note that after selecting the channel for freeze, the trace will continue to move until it reaches the rightmost side of the screen before it is frozen.

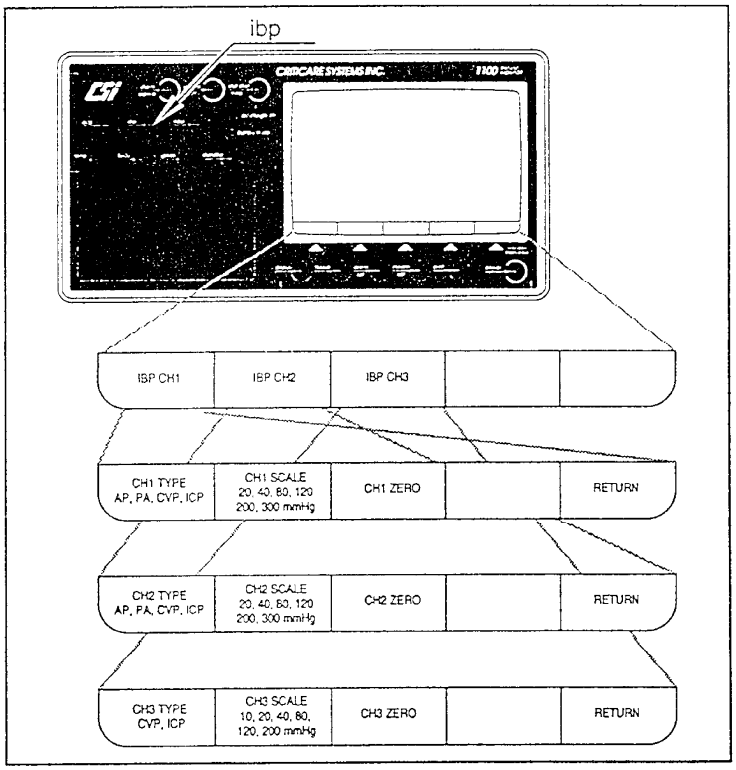
To freeze a waveform:

1. Press the monitor set key
2. Select ECG for channel 2
3. Press the ECG key
4. Select either Ch 1 or Ch 2 from the menu at the bottom of the screen.
5. Turn FREEZE on

Invasive Blood Pressure

IBP Setup Keys

Pressing the ibp key brings up a set of IBP-specific softkeys. The parameters currently in effect for the softkey are shown in the softkey windows. To change a parameter, press the softkey.



Using the softkeys, you can:

- Change the type of input on each channel
  - -- Arterial pulse (AP)
  - -- Pulmonary arterial pressure (PA)
  - -- Central venous pressure (CVP)
  - -- Intracranial pressure (ICP)
- Change the scale of the pressure waveform
- Zero the channel for calibration

IBP Setup Keys (cont.)

NOTE To change the sweep rate for the IBP waveforms, you must change the sweep rate for the ECG waveform.

NOTE If all IBP channels are turned off, the pressure waveform area of the monitor display is blank. Data measurements made by the IBP module are off.

The heart rate measurement may continue to display if either the ECG or the SpO_2 modules are on. For details, see **Precedence of Module Input** at the end of this section

To change a parameter:

1. Press the ibp key.
2. Press the softkey for the channel you want to set. A set of softkey labels for that channel show on the screen.
3. Set the channel signal parameters using the softkeys.
4. When you have finished setting the channel's parameters, press the RETURN softkey. The channel softkeys show again.
5. Repeat steps 2-4 to set the other channel parameters.
6. If no IBP softkeys are pressed for 30 seconds, the IBP softkeys will disappear.

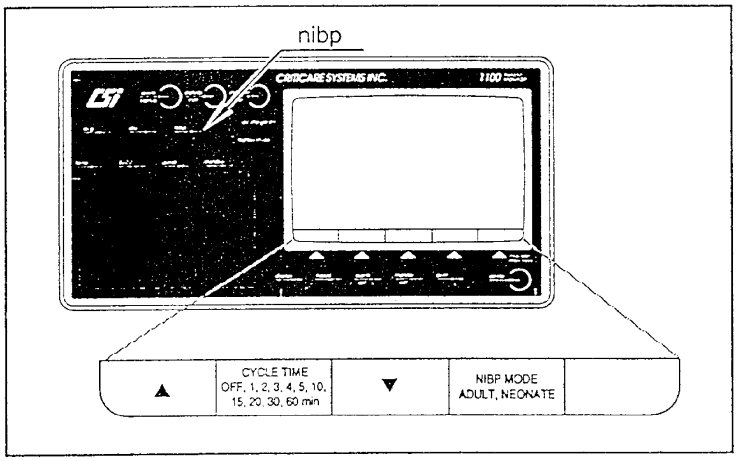
IBP Default Settings

Channel	Parameter	Default Setting
1	Type	AP
	Scale	0-200 mmHg
2	Type	PA
	Scale	0-40 mmHg
3	Type	CVP
	Scale	0-20 mmHg

Non-Invasive Blood Pressure

NIBP Setup Keys

Pressing the nibp key brings up a set of NIBP-specific softkeys. The parameters currently in effect for the softkey are shown in the softkey windows.



Using the softkeys, you can:

- Change the cycle time for taking an NIBP measurement (cycle time is the time between NIBP measurements)

NOTE

There are no waveform readings for the NIBP mode.

To change a parameter:

1. Press the nibp key.

2a. To change the cycle time, press the ▲ and ▼ softkeys on either side of the CYCLE TIME parameter.

2b. To select the NIBP mode (ADULT or NEONATE), press the NIBP MODE softkey until the desired mode is displayed.

3. If no NIBP softkeys are pressed for 30 seconds, the NIBP softkeys will disappear.

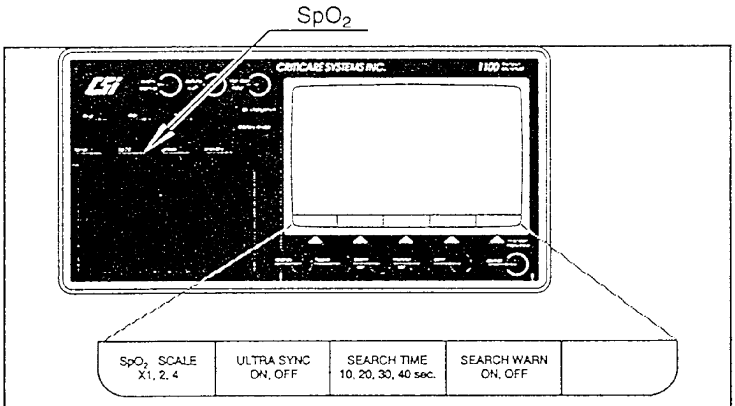
NIBP Default Settings

Parameter	Default Setting
Cycle time	3 min
NIBP mode	Adult
Cycle time	3 min
Cycle time	3 min

pO_2

SpO_2 Setup Keys

Pressing the SpO_2 key brings up a set of SpO_2-specific softkeys. The parameters currently in effect for the softkey are displayed in the softkey windows. To change a parameter, press the softkey.



Using the softkeys, you can:

- Change the scale of the SpO_2 waveform
- Turn UltraSync™ on and off

NOTE

The sweep rate for the SpO_2 waveform is determined from the ECG waveform sweep rate.

If both the ECG and IBP modules are off, the SpO_2 sensor provides a signal for the heart rate reading.

To change a parameter:

1. Press the SpO_2 key.
2. Press the softkey for the parameter you want to change.
3. If no SpO_2 softkeys are pressed for 30 seconds, the SpO_2 softkeys will disappear.

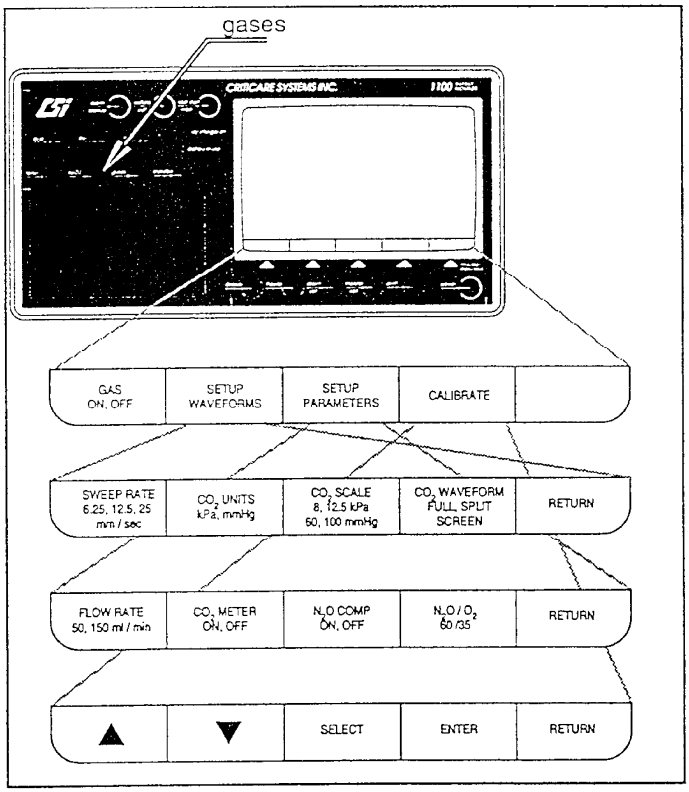
SpO_2 Default Settings

Parameter	Default Setting
Scale	X1
UltraSync™	off
Search Time	40 sec.
Search Warn	off

Gases

Gases Setup Keys

Pressing the gases key brings up a set of gas-specific softkeys. Parameters currently in effect display in the softkey windows. To change a parameter, press the softkey.



Using the softkeys you can:

- Turn the gas module on and off
- Set up the CO_2 waveform
- Set up the CO_2 parameters
- Calibrate all gases

Gases Setup Keys (cont.)

To change a parameter:

1. Press the gases key.
2. Press the softkey for the parameter you want to change.

   To set up the $etCO_2$ waveform:

   — Press the SETUP WAVEFORMS softkey.

   — Change the waveform parameters using the softkeys.

   — Press the RETURN softkey. If a key is not pressed, the softkeys disappear after 30 seconds.

   To set up the $etCO_2$ parameters:

   — Press the SETUP PARAMETERS softkey.

   — Change the parameters using the softkeys.

   — Press the RETURN softkey. If a key is not pressed, the softkeys disappear after 30 seconds.

NOTE

To calibrate the gases module, see **Section 3, Setup Procedures.**

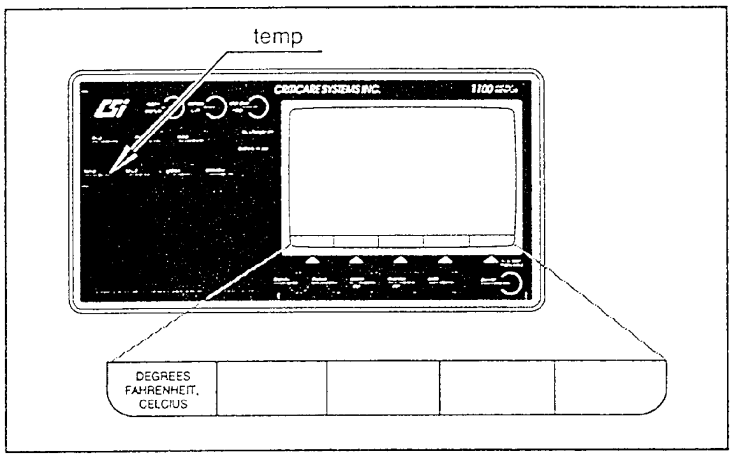
Gases Default Settings

Item	Parameter	Default Setting
Gas	on/off	on
Waveforms	sweep rate	12.5 mm/second
	CO2 Scale	60 mm Hg
	CO2 waveform	Full screen
Parameters	Flow rate	150 ml/min
	CO2 meter/capnograph	off
	units	mm Hg

Temperature

Temperature Setup Keys

Pressing the temperature key brings up a temperature-specific softkey. The parameters currently in effect for the softkey are displayed in the softkey windows. To change a parameter, press the softkey.



Using the softkeys, you can:

- Switch between Fahrenheit and Celsius scales

To change temperature scales, press the temp key.

The scale currently in use is displayed in the softkey window. You can toggle between degrees Celsius and Fahrenheit by pressing the DEGREES softkey.

Temperature Default Settings

Parameter	Default Setting
Degrees	Fahrenheit

Precedence of Module Input

When confidence mode = smart in the monitor set menu, the heart rate and respiratory rate patient parameters measured by the 1100 Patient Monitor have more than one possible source. The 1100 uses the following precedence to determine which module provides the patient data shown on the display:

Patient Parameter	Precedence
Heart rate	ECG IBP1 IBP2 SpO_2
Respiratory rate	Capnograph ECG (by impedance change)

Section 5 -- Viewing Patient Data

Section 5 — Viewing Patient Data

This section explains the available views of the patient data being measured. It shows the controls you use to:

- Switch from one view mode to another
- View data gathered over a period of time
- Mark the patient data to indicate the time when any significant event occurred
- Freeze images

How to Change the Display

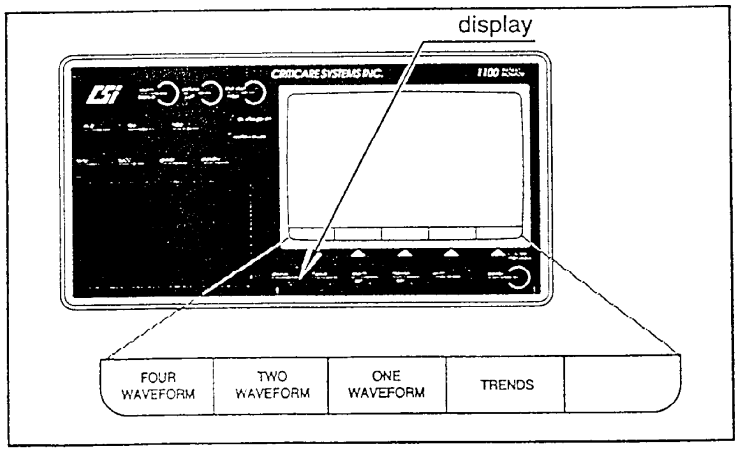
Four Display Modes

You select one of four display modes to tell the 1100 how you want patient data shown on the screen. A description of each of the four display modes follows the procedure for changing the display:

- Four waveform
- Two waveform
- One waveform
- Trends

Procedure to Select Display Mode

1. Press the display key. The display mode choices appear in the softkey windows
2. Press the softkey for the display mode you want. The display changes to that mode.



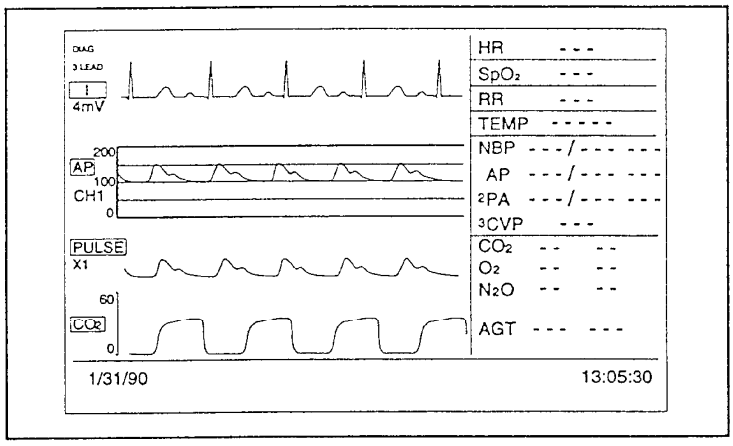
Descriptions of the Four Displays

Four Waveform Mode

The four waveform mode shows four waveforms for vital signs. The first waveform is always for ECG. The other waveforms can show any of the following:

- Invasive blood pressure (channel 1 or 2)
- Capnograph
- Plethysmograph

Measurements for other vital signs are shown numerically at the right.

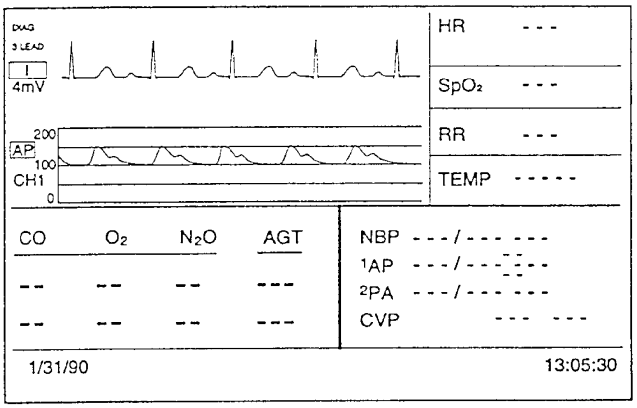


Two Waveform Mode

The two waveform mode shows two waveforms for vital signs. The first waveform is always for ECG. The other waveform can show any of the following:

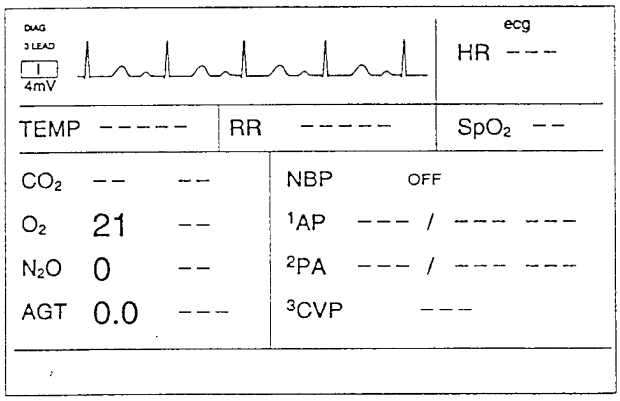
- Invasive blood pressure (channel 1 or 2)
- Capnograph
- Plethysmograph

Measurements for other vital signs are shown numerically to the right and below.



One Waveform Mode

The one waveform mode shows only ECG as a waveform. All other vital signs are shown in numerical form.

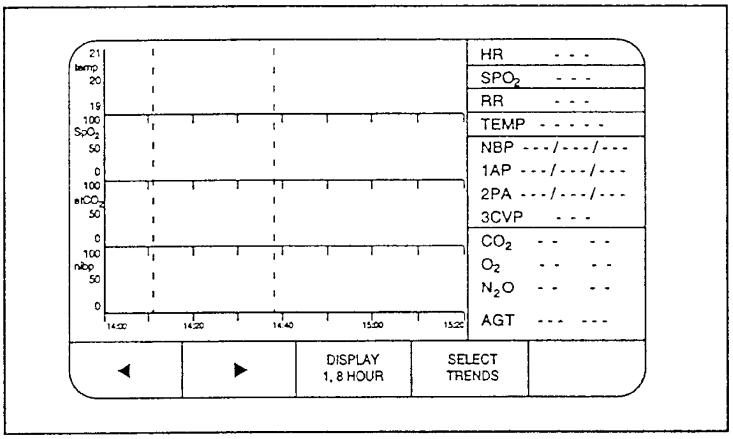


Trend Mode

The trend mode display changes the display to a graphic or tabular representation of patient data gathered over a period of time. Real-time measurements are shown numerically at the right-hand side of the screen.

As the monitor operates, it gathers and stores trend data in its internal memory. This information remains available for trend displays until the monitor is turned off.

A complete explanation of moving around in Trend Mode follows.



Explanation of Trend Mode

1 or 8 Hour Resolution

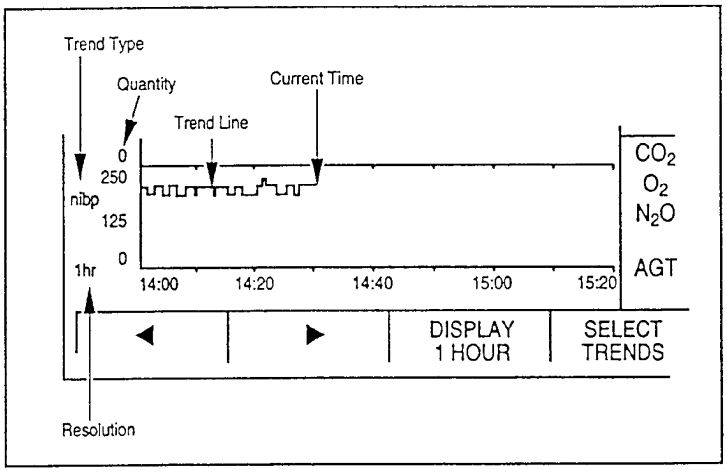
You may set the trend display for 1 or 8 hour resolution. Resolution is the period of time displayed on the screen. Pressing the DISPLAY 1, 8 HOUR softkey toggles the display between the two resolutions. You can change the resolution anytime during monitoring.

In either the 1 or 8 hour display you can shift the time period shown by pressing the arrow softkeys. The right arrow softkey moves the display forward in time, and the left arrow softkey moves the display backward. In the 8 hour mode, you use the arrow softkeys to select a 1 hour time slot you wish to see expanded.

After about one minute of monitoring, the quantity axis (y-axis) adjusts to show the trend data with the highest available resolution.

Example
The quantity axis for the heart rate trend defaults to a range of 0-250 bpm, but after measuring an average rate of 75 bpm, it will adjust to a range of 60-90 bpm.

The axis is updated periodically, using the patient's average reading for the latest time segment as the middle of the axis. The following is a typical trend display:

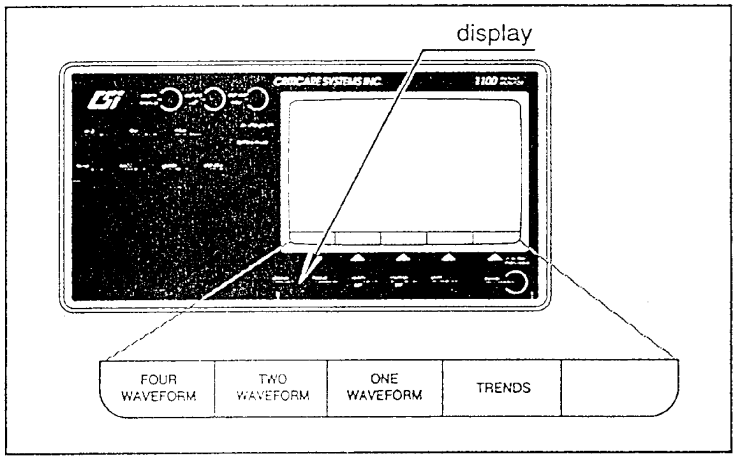


Setting Parameters for Trend Display

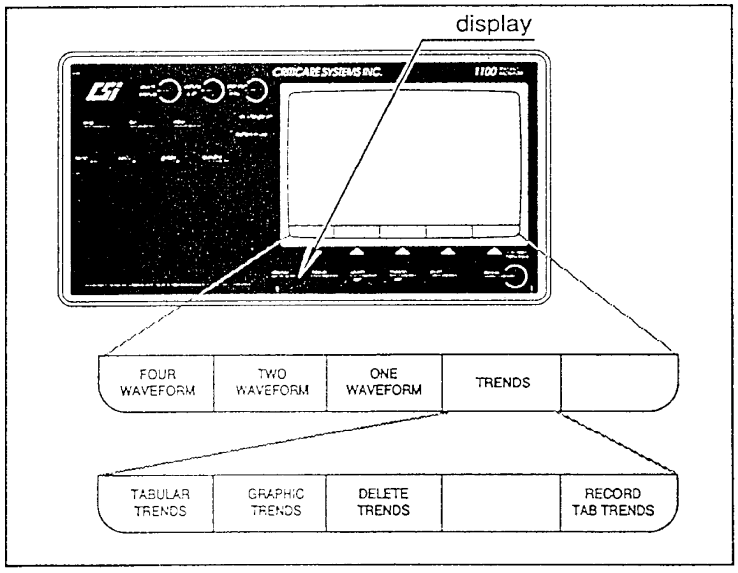
The parameters for the tabular or graphic trend display can be selected any time before or during monitoring. Selecting parameters does not affect data stored in the monitor's memory.

To select the parameters for the trend display:

1. Press the display key. The softkeys change as shown.

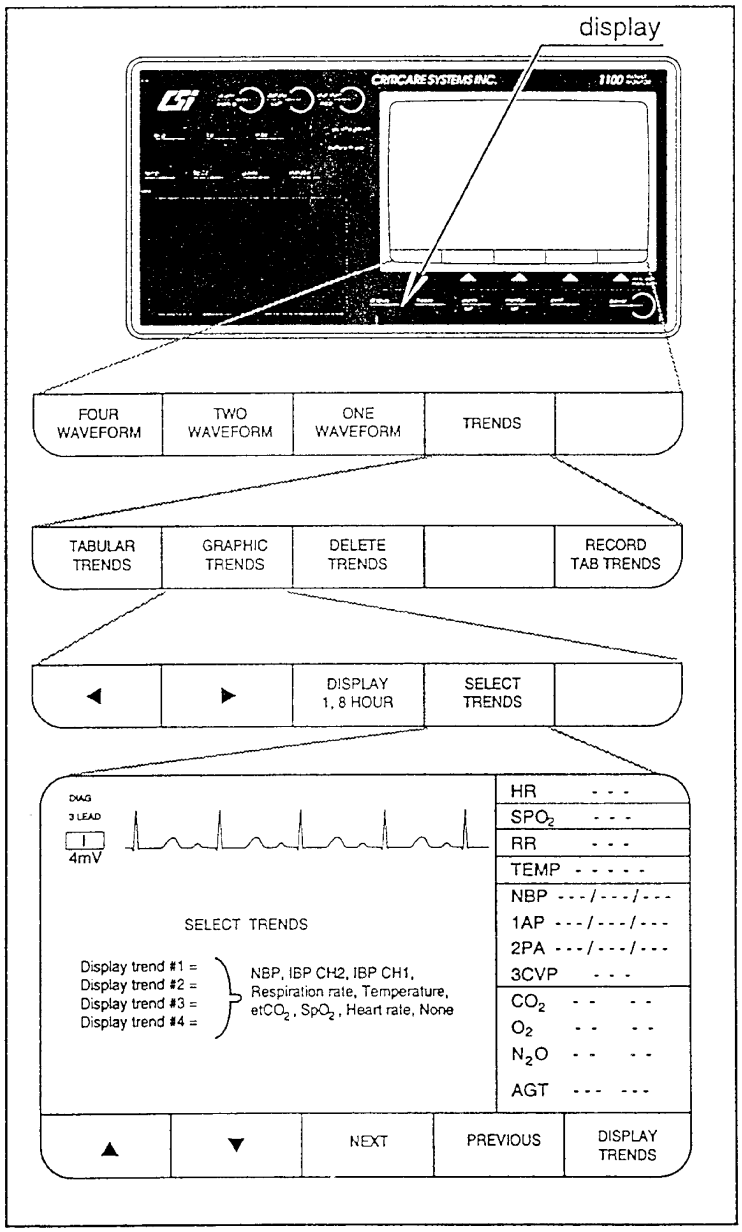


2. Press the TRENDS softkey. The softkeys change to the trend selection display as shown.



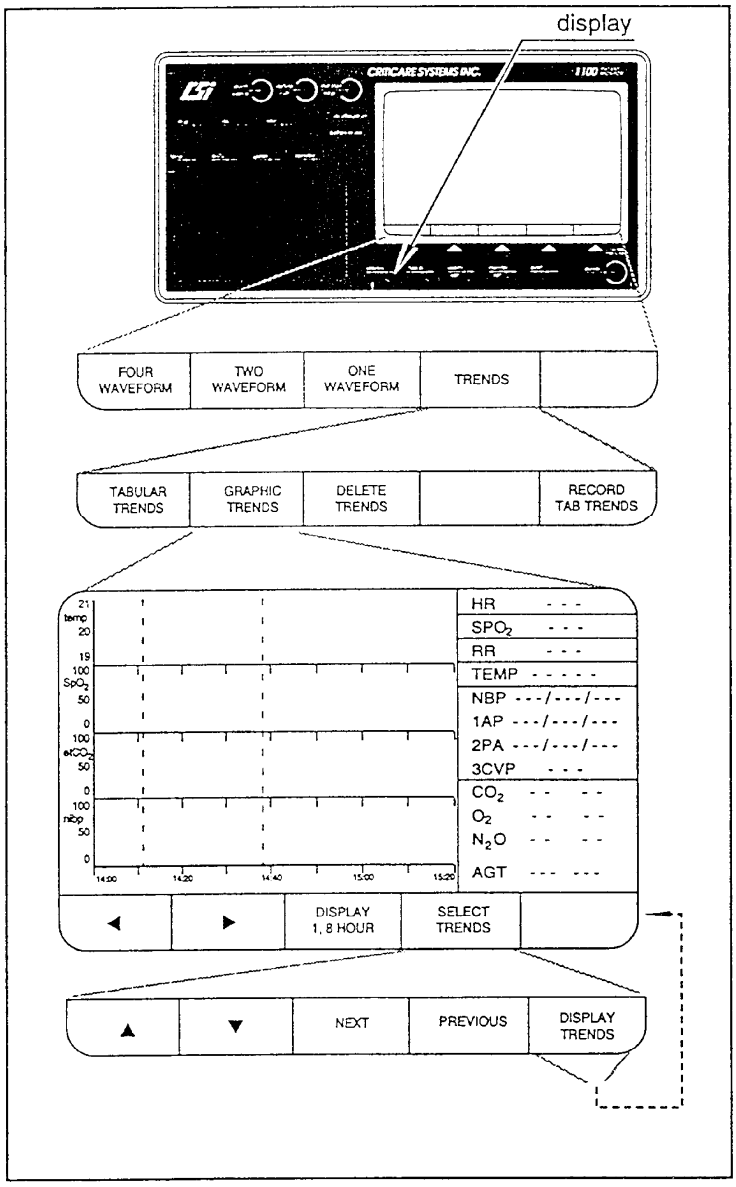
Setting Parameters for Trend Display (cont.)

3. To view the graphic trends screen, press the GRAPHIC TRENDS softkey. The display changes to the graphic trends display, and the softkeys change as shown. Press SELECT TRENDS to view the graphic trends setup display:



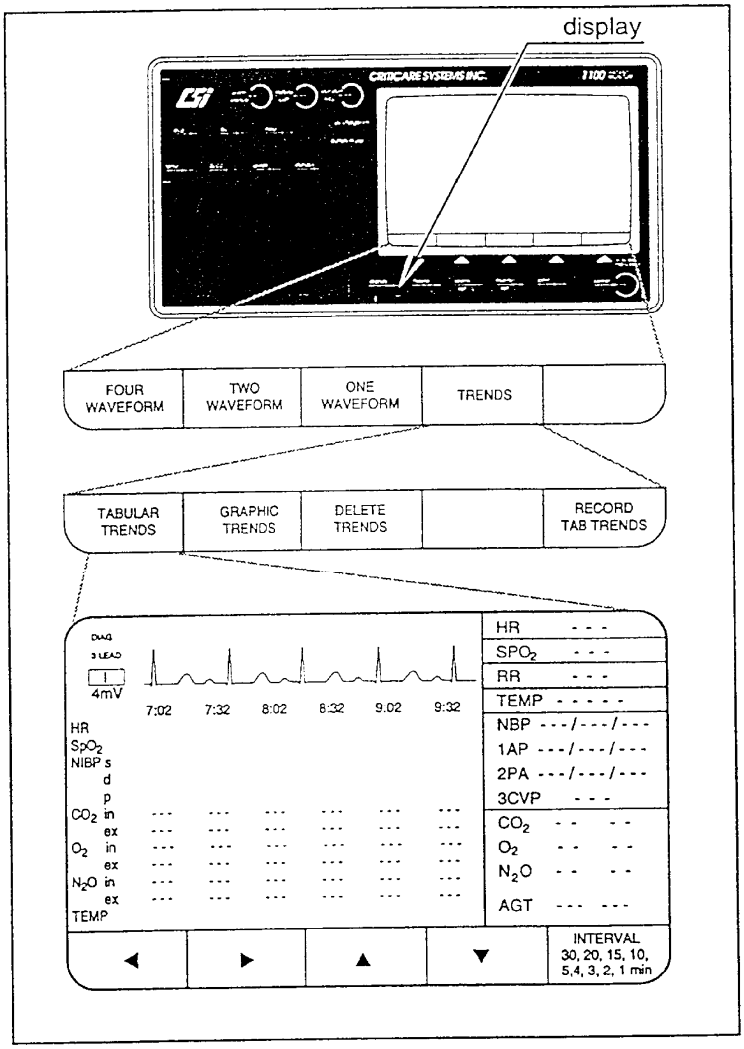
Setting Parameters for Trend Display (cont.)

4. Use the softkeys to select vital signs to trend. Only four of these may be shown at any one time. The NEXT and PREVIOUS keys move you up and down the menu, and the ▲ and ▼ keys change the menu selection. When done, press the DISPLAY TRENDS softkey to return to the graphic trends display as shown.



Setting Parameters for Trend Display (cont.)

5. To view the tabular trends screen, press the TABULAR TRENDS softkey. The display changes to the tabular trends display, and the softkeys change as shown.



When the tabular trends are initially displayed, the time at the top of the right-hand column is the current time. When the current time is in the right-hand column, that column will stay current, updating as determined by the interval setting.

Setting Parameters for Trend Display (cont.)

6. To print tabular trends of time, pulse rate, SpO_2, and systolic, diastolic, and mean blood pressure on the 1120 recorder, press the RECORD TAB TRENDS softkey. The interval for printing is determined by the interval setting for the tabular trend display. If the trend has already been recorded and a different time resolution is desired, re-select the display interval and record tabular trends again. For more information, see the strip chart recorder in **Appendix C -- Chart Recorder and Printer.**

Use the ◀ and ▶ softkeys to scroll backward or forward in time through the tabular trend data. If the 1100 has been acquiring trend data for less than 8 hours, the display will stop (when scrolling forward in time) at the current time. If the 1100 has been acquiring trend data for 8 hours or longer, the unit will "loop back" to the earliest acquired trend data.

Use the ▲ and ▼ softkeys to scroll up and down through the complete tabular trends display. (Only part of the display fits on the screen without scrolling.)

Press the INTERVAL softkey to set the tabular trends display to the desired time interval. The time interval is always incremented from the time appearing in the right-most column.

Leaving the Trend Mode

To leave the trend mode, press the display key. The screen will revert to the mode it was in before you selected trends.

Example:
If the display was in ONE WAVEFORM mode before you entered the trend mode, the display will revert to ONE WAVEFORM mode when you leave the trend mode.

Special Function Keys

Standby Key The standby key allows you to enter and exit standby mode. In standby mode, all audible alarms are silenced and alarm limits are set to factory default values.

Freeze Key You can freeze the waveforms by pressing the freeze key. The waveforms remain as they were when you pressed the freeze key.

The waveforms remain frozen until you press the freeze key again. When you press freeze to resume the display resets and the waveforms continue to update in the window.

NOTE In freeze mode, numeric and trend data continue to update although the waveforms are frozen.

Section 6 -- Periodic Maintenance

Section 6 — Periodic Maintenance

This section covers maintenance to the 1100 Patient Monitor and its sensors. There are no user-serviceable parts inside the monitor. For maintenance inside the monitor, call a CSI-approved service center.

⚠ CAUTION ⚠ Do not attempt to clean the internal pneumatic system. The filters in the Water Chek™ device prevent any fluid or particular matter from entering the internal system.

⚠ CAUTION ⚠ Replace the $C0_2$ absorber and O_2 sensor yearly. The system must be recalibrated when the O_2 sensor is replaced.

Exterior Cleaning

⚠ WARNING ⚠ TURN THE POWER OFF BEFORE CLEANING THE MONITOR AND SENSOR. NEVER IMMERSE THE MONITOR OR SENSOR IN LIQUIDS.

⚠ CAUTION ⚠ Do not use abrasive cleaners on the monitor or sensor.

⚠ CAUTION ⚠ Wipe the exterior surface of the 1100 monitor with alcohol. Dry with a clean cloth.

⚠ CAUTION ⚠ Wipe the surface of the Perm. filter sensor (Cat. No. 511), SPO_2 LEDs and photodetector with alcohol. Dry with a clean cloth. Do not immerse the finger sensor in liquids.

Replacing CO_2 Absorber

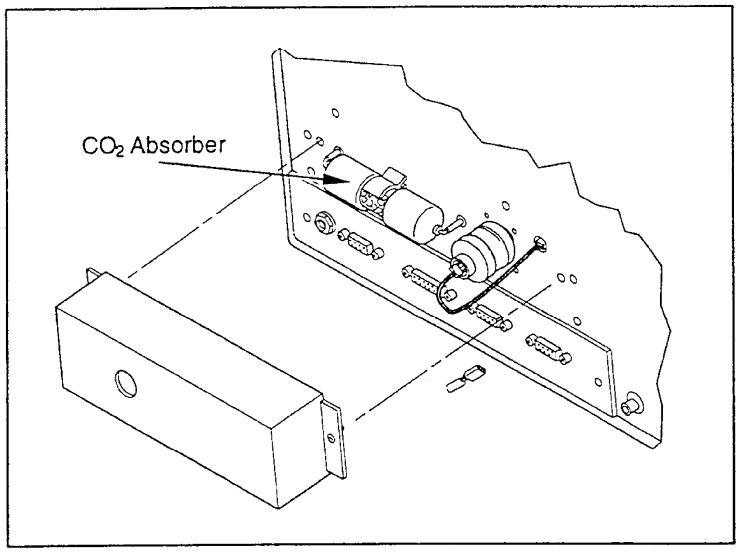
Replace the CO_2 absorber when the color of its granules changes from white to purple.

Removal

1. At the rear of the monitor, loosen the two captive screws holding the protective cover in place. Remove the cover.
2. Disconnect the absorber tubes from the inlet and outlet ports by gently pulling the tubes.
3. Remove the absorber from the clip.
4. Remove the tubes from the absorber and place the tubes back on the unit. Discard the absorber.
5. Follow the directions for installing a new absorber.

Installation

1. Place a new CO_2 absorber in the clip at the rear of the monitor.
2. Connect the absorber to the tubes on thee inlet and outlet ports.
3. Install the protective cover and tighten the captive screws.



Replacing O_2 Sensor

The O_2 sensor should be replaced only by qualified personnel familiar with the procedure in the *1100 Patient Monitor Service Manual.*

Notify qualified personnel when you see this message on the screen:

OXY CELL VOLTAGE LOW

⚠ CAUTION ⚠ **The 1100 must be recalibrated after the O_2 sensor is replaced.**

Annual Safety Tests

The monitor should be electrically tested annually as follows:

Ground Resistance

Measure the electrical safety ground resistance using a ROD-L Electronics 25 ampere ground tester.

- The first measured value should be < 0.1 ohm.

Leakage Current Testing

ENCLOSURE LEAKAGE CURRENT

Measure the enclosure leakage current using a Dynatech 232D Safety/ECG Analyzer.

- The first measured value should be < 50 microamperes for normal polarity.
- The first measured value should be < 50 microamperes for normal polarity with open ground.
- The first measured value should be < 50 microamperes for normal polarity with open neutral.

PATIENT LEAKAGE CURRENT

Measure the patient leakage current using a Dynatech 232D Safety/ECG Analyzer.

- The first measured value should be < 20 microamperes for normal polarity.

Patient Cable Testing

Patient cables (ECG, SPO_2, temperature, power cord, printer, etc.) should be checked periodically for damage, loose wires/ connections, loose connectors, cracked housing, etc.

System Testing

The 1100 monitor has two sets of built-in system tests which should be run regularly by *authorized service personnel*. One is for gases, the other is for general tests. To enter the gases tests, the system should be powered up while the "gases" key is pressed. To enter the other tests, the system should be powered up while the "standby" key ("event" key prior to software version 2.4) is pressed.

Once the system is powered up, a set of Test Menus will be available. To exit the 1100 Service Modes, the system must be powered down, then powered up again. The test modes are:

1) **NIBP Test:** This set of tests allows for the verification of the noninvasive blood pressure operation. It requires the use of special equipment to test pressure.
2) **CRT Calibration Test:** This test is used to set up and verify the calibration of the CRT.
3) **DUART Test:** This test verifies the ports on the 1100 monitor. It requires the use of special loop-back plugs. The tests verify the computer, the printer, and the recorder outputs.
4) **DAC Test:** This test verifies the analog outputs on the back panel of the master board of the 1100 monitor. Measurements must be verified using an ohm meter.
5) **Gases Test:** This set of tests allows for the calibration and verification of the gas agent bench. Special equipment is necessary to perform the calibration and tests.

Refer to the **Model 1100 Service Manual** for additional information.

Battery Replacement

The battery should be replaced only by qualified service personnel and only replaced with a battery acquired through CSI. No substitutes should be used.

Appendix A — Error Messages

Error messages are shown in one line at the bottom of the display. Some of these messages indicate errors which should be corrected to maintain system accuracy. Other messages are of an informational nature. While the error is in effect, the corresponding message is shown. If more than one error occurs, the messages are shown alternately. The following table shows the possible error messages and the actions you should take:

Message	Action to be taken
RA ECG ELECTRODE OFF	Check RA ECG electrode.
RL ECG ELECTRODE OFF	Check RL ECG electrode.
LA ECG ELECTRODE OFF	Check LA ECG electrode.
LL ECG ELECTRODE OFF	Check LL ECG electrode.
C ECG ELECTRODE OFF	Check C ECG electrode .
ECG ELECTRODES OFF	Check all ECG electrodes.
ECG NOT RESPONDING	Call CSI Customer Service.
BP NOT RESPONDING	Call CSI Customer Service.
OXIMETER NOT RESPONDING	Call CSI Customer Service.
GAS NOT RESPONDING	Call CSI Customer Service.
CHECK SpO_2 SENSOR SITE	Make sure sensor is properly on finger.
SpO_2 HIGH AMBIENT	Cover sensor to keep high ambient light from affecting readings.
SpO_2 PULSE AMPLITUDE LOW	Check sensor.
SpO_2 PULSE SEARCH	Pulse is too weak to measure. Check sensor.
NIBP CUFF/HOSE LEAK	Check for leaks.
CHECK NIBP CUFF	Check cuff.
NIBP EXCESSIVE MOTION	Informational
NIBP REINFLATION	Informational
NIBP IRREGULAR PULSE	Informational

Appendix A, continued

Message	Action to be taken
NIBP NOISY PULSE	Informational
NIBP NOT RESPONDING	Call CSI Customer Service.
CHECK NIBP MODE	A neonate NIBP cuff has been detected while in Adult NIBP mode.
NIBP EXCEEDED MAX TIME	Retry measurement.
NIBP EXCEEDED MAX PRESS	Retry measurement.
NIBP EXCEEDED MAX PULSES	Retry measurement.
NIBP PULSE AMPLITUDE LOW	Informational
NIBP CUFF DISCONNECTED	Call CSI Customer Service.
IBP1 INVALID XDUCER ZERO	Retry zeroing.
IBP2 INVALID XDUCER ZERO	Retry zeroing.
IBP1 PULSE AMPLITUDE LOW	Pulse is too weak to measure.
IBP2 PULSE AMPLITUDE LOW	Pulse is too weak to measure.
BP HARDWARE ERROR	Call CSI Customer Service.
ALARMS SILENCED	Informational
GAS LINE OCCLUDED	Wait for line to clear, or replace gas line, or replace Water Chek™.
REPLACE WATER TRAP	Replace Water Chek™.
ALARM AUDIO OFF	Informational
GAS BENCH FAILURE	Call CSI Customer Service.
LOW BATTERY	Battery has been in operation for about 15 minutes, plug monitor into power socket.
IBP3 INVALID XDUCER ZERO	Retry zeroing.
ZERO IBP1 XDUCER	Transducer needs zeroing.
ZERO IBP2 XDUCER	Transducer needs zeroing.
ZERO IBP3 XDUCER	Transducer needs zeroing

Appendix A, continued

Message	Action to be taken
INSERT WATER TRAP	Replace Water Chek™
GAS BENCH WARMING UP	Informational
GAS AUTO CALIBRATION	Informational
OXY CELL VOLTAGE LOW	Call CSI Customer Service.
OXY CELL EXPIRED	Call CSI Customer Service.
NO AGENT FACTORY CAL	Call CSI Customer Service.
NO AGENT ID FACTORY CAL	Call CSI Customer Service.
LOW AGENT SIGNAL	Call CSI Customer Service.
LOW AGENT REF SIGNAL	Call CSI Customer Service.
NO N_2O FACTORY CAL	Call CSI Customer Service.
NO N_2O SIGNAL	Call CSI Customer Service.
LOW N_2O REF SIGNAL	Call CSI Customer Service.
MIXED AGENTS	There is more than one anesthetic agent in the gas mixture.
GAS BENCH COMM FAILURE	Call CSI Customer Service.
1120 NOT RESPONDING	Check setup. Call CSI Customer Service.
1120 ILLEGAL COMMAND	Call CSI Customer Service.
1120 OUT OF PAPER	Replace the paper roll in the strip chart recorder
1120 DOOR OPEN	Close the paper roll door on the strip chart recorder
1120 THERM ARRAY OVERHEAT	Allow the strip chart recorder to cool before trying to print
1120 AC VOLTAGE LOW	Call CSI Customer Service
1120 AC VOLTAGE HIGH	Call CSI Customer Service
1120 EEPROM ERROR	Call CSI Customer Service

Appendix B — Accessories

Catalog No.	Description
511	Oxygen Saturation Sensor (Adult Finger Sensor)
513	Forehead Applicator and Headband
514	Earclip Attachment
516	Multi-Site Sensor Package: Sensor, Patient Cable, Earclip, Adhesive Dots, Forehead Applicator, Headband
517	Multi-Site Sensor (only)
518	Patient Cable only
525	Double-Sided Adhesive Dots
526	Tape - Microfoam (4" strips, 14 per package)
527	ECG Electrodes - Disposable (package of 3)
527/5	ECG Electrodes - Disposable (package of 5)
528	YSI 400 Series Temperature Cable
577	3 wire ECG/Resp Cable
563	5 wire ECG/Resp Cable
556/3	Package of 3 Leads (Black, Red, and White)
556/5	Package of 5 Leads (Black, Red, White, Brown, and Green)
570	Adult Disposable Sensor (25mm)
571	Pediatric Disposable Sensor (20mm)
572	Infant Disposable Sensor (20mm)
573	Neonatal Disposable Sensor (25mm)
574	Disposable Sensor Variety Pack
611	Cal Kit (CO_2 only) 3 ea 7EOC cylinders in case with regulator and cal fitting

Catalog No.	Description
613	Cal fitting for use with 7EOC cylinders
614	Cal fitting for use with aerosol can
616	Adaptor, E.T. Straight (Box of 10)
617	Adaptor, E.T. Elbow (Box of 10)
618	Disposable Waterchek
620	Cal gas, 7EOC cylinder 100% N_2
621	Cal gas, 7EOC cylinder 5% CO_2, Bal N_2
622	Cal gas, 7EOC cylinder 10% CO_2, Bal N_2
623	Regulator for 7EOC cylinder
624	Disposable Nasal Cannula with luer lok connection for $ETCO_2$ sample line
625	Replacement sample line (for 626 only)
626	Reusable Waterchek with enlarged collection chamber (box of 5 and 15 sample lines)
630	Anesthetic Agent Calibration Kit includes: Cal gas aerosol, 1% enflurane, 5% CO_2, 60% N_2O, Bal N_2 Cal gas aerosol, 1% isoflurane, 5% CO_2, 60% N_2O, Bal N_2 Cal gas aerosol, 1% halothane, 5% CO_2, 60% N_2O, Bal N_2
641	Check Cal gas aerosol, 5% CO_2 Bal N_2 (for calibration check)
642	Check Cal gas aerosol, 10% CO_2 Bal N_2 (for calibration check)
644	O_2 Sensor
655	Scavenging Kit (19mm M/F)
909	Power Cord (North American)
910	Power Cord (International)

Catalog No.	Description
1108	Serial Printer Cable
1110	Interface Cable for 1120 Recorder
1111	1100 Patient Monitor Operator Manual
1120	Two Channel Strip Recorder 1120-1 (US only) 1120-2 (Domestic/Canada/ Europe)
1121	Thermal Recorder Paper (one roll)
1122	Accessory Cordset for 1100-1120 (required to supply power from the 1100 monitor to the 1120 recorder)
1150	19" Remote Monitor
80131B001	Fuse for 1120 recorder, 2A/250V Slo-Blo, 5 x 20 mm, US/Canada
80131B002	Fuse for 1120 recorder, 2A/250V Slo-Blo, 5 x 20 mm, Europe

Appendix C -- Chart Recorder and Printer

Appendix C — Chart Recorder and Printer

Appendix C — Chart Recorder and Printer

This section describes the use of the 1100 patient monitor with the 1120 Strip Chart Recorder and/or the serial printer.

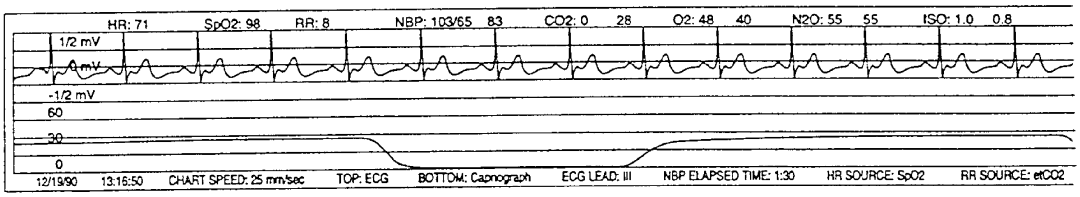
1120 Strip Chart Recorder

The 1120 Strip Chart Recorder is a device for recording patient parameters. It uses a silent thermal printing process to record patient information. The recorder prints patient information, including,

- Heart rate
- SpO_2
- Respiration rate
- Temperature
- Noninvasive blood pressure
- Invasive blood pressure (three channels)
- Gas concentrations

The recorder also prints two waveforms. The waveforms printed are the same as the Analog A and B waveforms from the Monitor Set menu.

Below the waveforms, the recorder indicates the date and time, the chart speed, the waveforms printed, and the sources for the data in the printout. The following is a sample printout:



This appendix contains procedures for the following:

- Cabling the recorder
- Using the recorder
- Recorder maintenance

Cabling the Recorder

CONNECT SERIAL CABLE

⚠ CAUTION ⚠

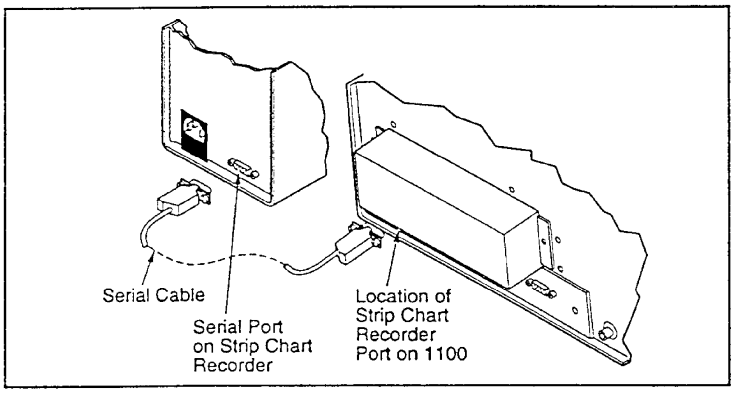
Do not connect the serial cable with the monitor or strip chart recorder power cords plugged in. Unplug the power cords from their power sources before connecting the serial cable. Connecting the serial cable with the monitor or recorder plugged in can damage the monitor and recorder.

⚠ CAUTION ⚠

Do not connect the serial cable with the monitor turned on. The monitor uses a battery backup, and it can be turned on even though the power cord is unplugged. Turn off the monitor before connecting the serial cable. Connecting the serial cable with the monitor turned on can damage the monitor and recorder.

To communicate with the 1100 Patient Monitor, the 1120 recorder uses a serial cable, Criticare catalog number 1107. To attach the cable:

1. Turn off the monitor.
2. Unplug the monitor and the strip chart recorder power cords from their power sources.



Cabling the Recorder (cont.)

3. Connect the serial cable to the port on the rear of the recorder and to the Strip Chart Recorder port on the rear of the monitor.
4. Secure the cable to the ports with the captive screws on the cable connectors.

CONNECT POWER CORDS

⚠ WARNING ⚠

USE THE 1100 PATIENT MONITOR ONLY WITH THE SUPPLIED CRITICARE POWER CORD. USE OF A NON-APPROVED CORD MAY CAUSE SHOCK TO THE OPERATOR OR PATIENT.

BE SURE THE POWER PLUG IS CONNECTED TO THE 1100 MONITOR BEFORE YOU PLUG THE CORD INTO AN ELECTRICAL OUTLET. USE HOSPITAL-GRADE OUTLETS ONLY.

1. Attach the supplied power cords to both the monitor and recorder.
2. Plug the monitor and recorder into approved hospital-grade power outlets.

Using the Recorder

Setup Parameters

The 1120 recorder is controlled through the 1100 Patient Monitor. The control parameters for the recorder are contained in the monitor setup screens.

ENTER THE MONITOR SET SCREEN

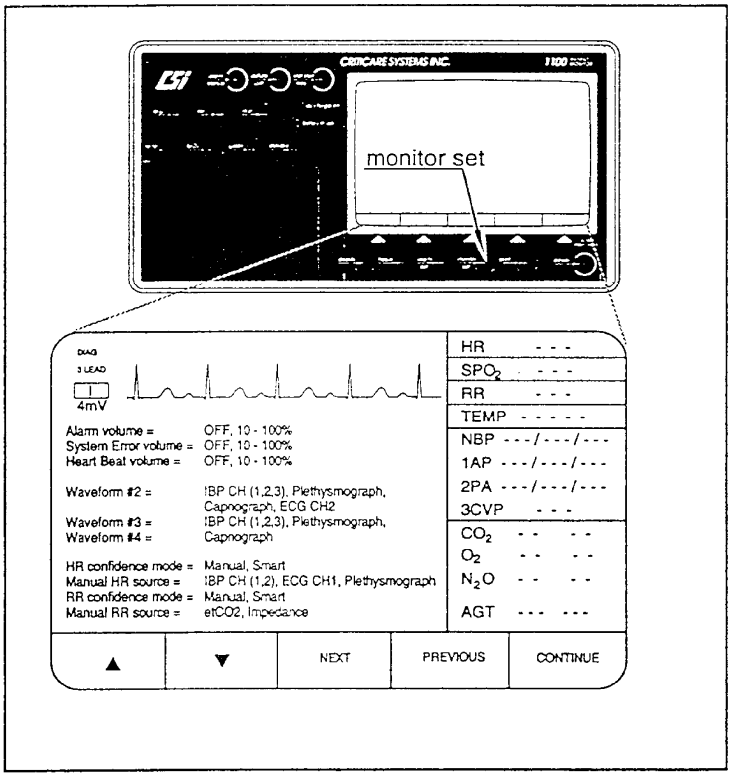
The monitor set screen allows you to set:

- The waveforms the recorder prints
- The conditions under which the recorder prints

Using the Recorder (cont.)

To enter the monitor set screen and retrieve the strip chart recorder parameters:

1. Press the monitor set key. The monitor set menu appears on the screen in place of the waveforms. The ECG waveform remains active.



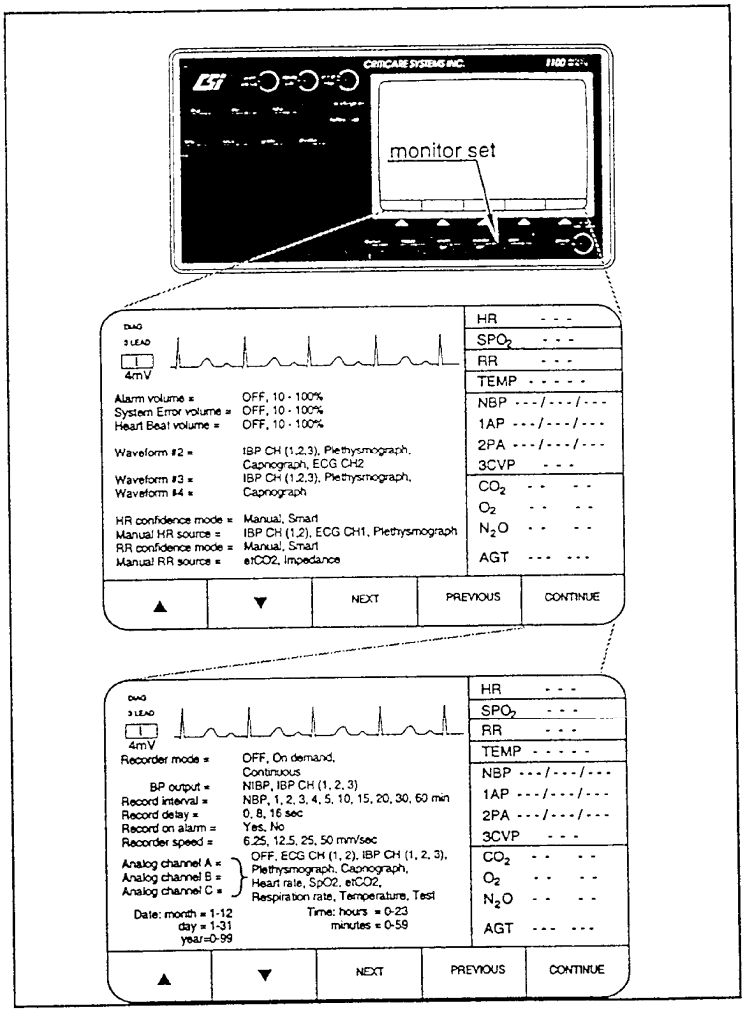
2. Press the CONTINUE softkey to move to the second screen of monitor set parameters. The second screen contains the setup parameters for the strip chart recorder.

SELECT WAVEFORMS

The printout has space for two waveforms. These waveforms correspond to the Analog A and B channels.
To select a waveform to print:

1. Press the NEXT and PREVIOUS softkeys until the Analog A or Analog B channel parameter is highlighted.
2. Press the ▲ and ▼ softkeys until the option you want shows on the screen.

Using the Recorder (cont.)



SET RECORDER MODE

In addition to the "Record on alarm" function, there are four ways to print a strip chart:

- On demand, which prints a chart when you press the print key. The chart stops printing after one set of patient parameters has been printed. If the Record Delay is set, the chart will also include information preceding the request. The length of this portion of the chart will depend on the Record Delay time and will not be annotated. Unless the Recorder Mode is set to continuous, pressing the print key will print an on demand chart.

Using the Recorder (cont.)

- Periodic, which prints a chart after a certain amount of time has elapsed. The interval is selected via the "Record interval" parameter. The chart stops printing after one set of patient parameters has been printed. The Record Delay setting has no impact on the printed chart.
- Continuous, which continuously prints a chart after you press the print key. The chart stops printing when you press the print key again. The Record Delay setting has no impact on the printed chart.

To select the Recorder mode:

1. Press the NEXT and PREVIOUS softkeys until the "Recorder mode" parameter is highlighted.
2. Press the ▲ and ▼ softkeys until the mode you want shows on the screen.

SET RECORD ON ALARM

With the "Record on alarm" parameter set to "yes", the recorder starts printing when an alarm condition is reached, regardless of other recorder mode settings. The chart stops printing after one set of patient parameters has been printed. If the Record Delay is set, the chart will also include information preceding the request. The length of this portion of the chart depends on the Record Delay time and will not be annotated.
To set the Record on alarm parameter:

1. Press the NEXT and PREVIOUS softkeys until the "Record on alarm" parameter is highlighted. This is a yes or no selection.
2. Press the ▲ and ▼ softkeys until the option you want shows on the screen.

SET RECORD INTERVAL

The record interval is the amount of time between periodic chart recordings. This parameter is used with the periodic print mode.
To set the record interval:

1. Press the NEXT and PREVIOUS softkeys until the "Record interval" parameter is highlighted.
2. Press the ▲ and ▼ softkeys until the option you want shows on the screen.

Using the Recorder (cont.)

RETURN TO DISPLAY MODE

When you have finished making your selections, press the display key to return to the waveforms display.

Printing a Chart

AUTOMATIC RECORDER ACTIVATION

To automatically record on alarm or at an interval:

1. Select the Record mode parameter. See the setup parameters in this section.
2. Recording occurs automatically at the following times, depending upon parameter settings:
   - at the end of the selected record interval
   - at the end of the selected NBP interval
   - when the patient is in alarm

MANUAL RECORDER ACTIVATION

To manually record a chart on demand:

1. Select the "On-demand" print mode parameter. (See the setup parameters in this section.)
2. To start printing a chart, press the print key. The chart recorder will print one complete chart, then stop automatically.

If you set the record mode parameter to record at an interval, you can still print an on-demand chart. For instance, you can print an on-demand chart even though you set the record mode to NBP periodic. To record an on-demand chart, press the print key. The recorder prints a chart with one complete set of patient parameters. The strip-chart recorder will print the current values and then stop automatically.

To manually record a continuous chart:

1. Select the "Continuous" print mode parameter. (See the setup parameters in this section.)
2. To start printing a chart, press the print key. The strip chart recorder will continuously print a strip chart until you press the print key again.
3. To stop printing, press the print key

Printer Output

The printer output provides a means of sending patient data from the 1100 Patient Monitor to a serial printer. The data is sent as an RS-232 signal from the PRINTER/ANALOG DB-15 connector on the rear panel of the 1100. The printer output mode is selected via the Monitor Set menu.

Printer Output Modes

The available printer output modes are:

- off
- on demand
- NBP periodic
- periodic

Printer Output Data

These modes are the same for the printer output as they are for the 1120 Strip Chart Recorder. Refer to the Setup Parameter information for the strip chart recorder in this section for detailed information about each mode.
The patient data transferred to the printer consists of :

- date
- time
- heart rate
- blood pressure
- respiration rate
- temperature
- CO_2
- O_2
- N_2O
- agent

A sample printout is shown on the following page.

Printer Output Data (cont.)

Patient Name: _____ ID#:_____

Procedure:_____ Sex: M / F DOB:_____

Date: 4/02/92

TIME	HR	SpO2	BP s / d / m	RR	TEMP	CO2 i / e	O2 i / e	N2O i / e	AGENT id	AGENT i / e
21:20:45	60	98	120/80/93	20	98.5	0/38	42/40	47/42	ISO	1.1/ .6
21:21:03	60	98	120/80/93	20	98.5	0/38	42/40	47/42	ISO	1.1/ .6
21:21:08	60	98	120/80/93	20	98.5	0/38	42/40	47/42	ISO	1.1/ .6
21:21:12	60	98	120/80/93	20	98.5	0/38	42/40	47/42	ISO	1.1/ .6
21:21:14	60	98	120/80/93	20	98.5	0/38	42/40	47/42	ISO	1.1/ .6

Printer Cable

A serial printer cable (Catalog No. 1108) for the 1100 patient monitor is available from Criticare Systems, Inc.

To Print

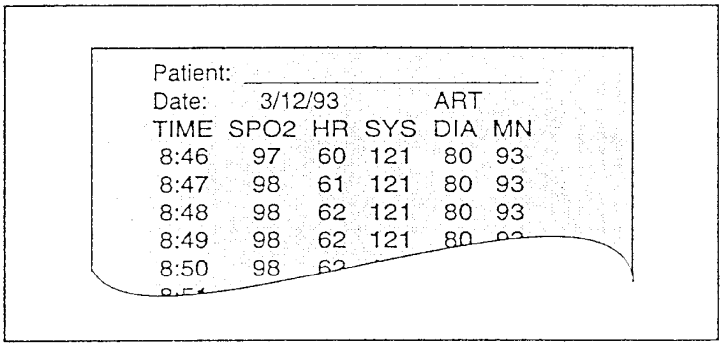
Printing is initiated by pressing the PRINT key. If the printer output is in any mode *except* OFF, the printer will print the current values when the PRINT key is pressed. If the printer output mode is OFF, pressing PRINT will have no effect on the printer.

To eject the current sheet of paper and load a new sheet with a header, press the PRINT key and hold it for one second.

Tabular Trends Using the 1120 Recorder

To print tabular trends of time, pulse rate, SpO_2, and systolic, diastolic, and mean blood pressure on the 1120 recorder, press the RECORD TAB TRENDS softkey. The interval for printing is determined by the interval setting for the tabular trend display. If the trend has already been recorded and a different time resolution is desired, re-select the display interval and record tabular trends again.

An example of a tabular trend printout is shown in the following illustration.

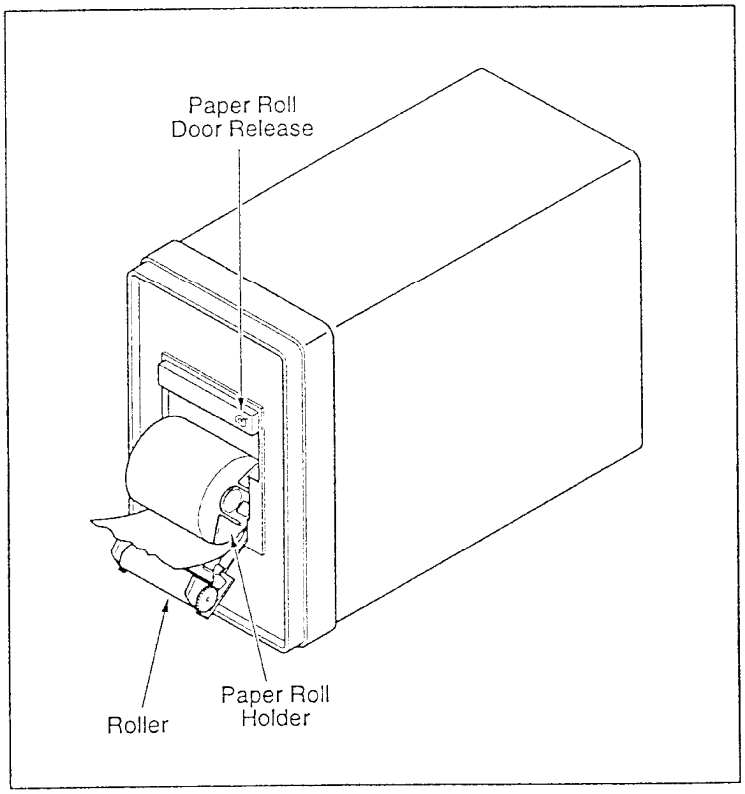


Recorder Maintenance

Replacing the Paper Roll

When the recorder runs out of paper, an error message appears on the monitor. The message reads: 1120 OUT OF PAPER. To replace the paper roll:

1. Press the paper roll door release button. The paper roll holder falls forward.
2. Remove the old paper roll by pulling up on the roll. It should release easily.
3. Install a new roll so the paper dispenses from the bottom of the roll, as shown below.



4. Center the paper on the roller and close the paper roll door.
5. Press the print key to resume printing.

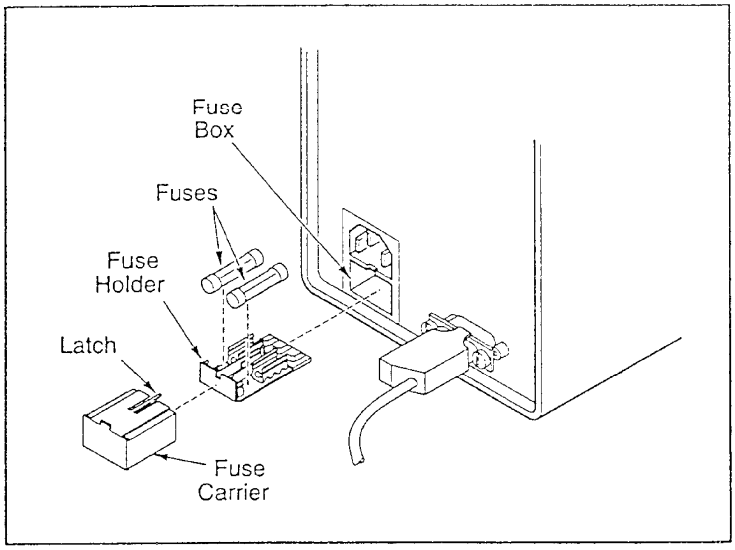
Replacing the Strip Chart Recorder Fuses

⚠ WARNING ⚠

UNPLUG THE STRIP CHART RECORDER FROM ITS POWER SOURCE BEFORE REPLACING FUSES. ATTEMPTING TO REPLACE THE FUSES WITHOUT DISCONNECTING POWER MAY RESULT IN INJURY OR DEATH.

If you suspect a fuse in the strip chart recorder is blown:

1. Disconnect the strip chart recorder from its power source.
2. Pry open the fuse box located directly under the strip chard recorder power inlet, and remove the fuse carrier from the fuse box.
4. Gently pry the fuse carrier latch upward, and pull the fuse holder out of the fuse carrier.



⚠ CAUTION ⚠

Replace the strip chart recorder fuses only with fuses of the same specifications. If you use a different fuse type, equipment damage may occur.

Replacing the Strip Chart Recorder Fuses (cont.)

5. Inspect the fuses. If a fuse is blown, replace it with a 2 amp, 250V fuse. See Appendix B, Accessories, for the fuse part number for your recorder.
6. Install the fuse holder into the fuse carrier. A click sounds when the holder is in place.
7. Install the fuse carrier into the fuse box. A click sounds when the carrier is in place.

Appendix D -- Serial Output

Appendix D — Serial Output

The 1100 Patient Monitor provides a serial output from the COMPUTER INTERFACE connector on the rear panel. The parameters for these outputs are selected from the 1100 Patient Monitor via the monitor met menu.

To set the serial output, perform the following steps:

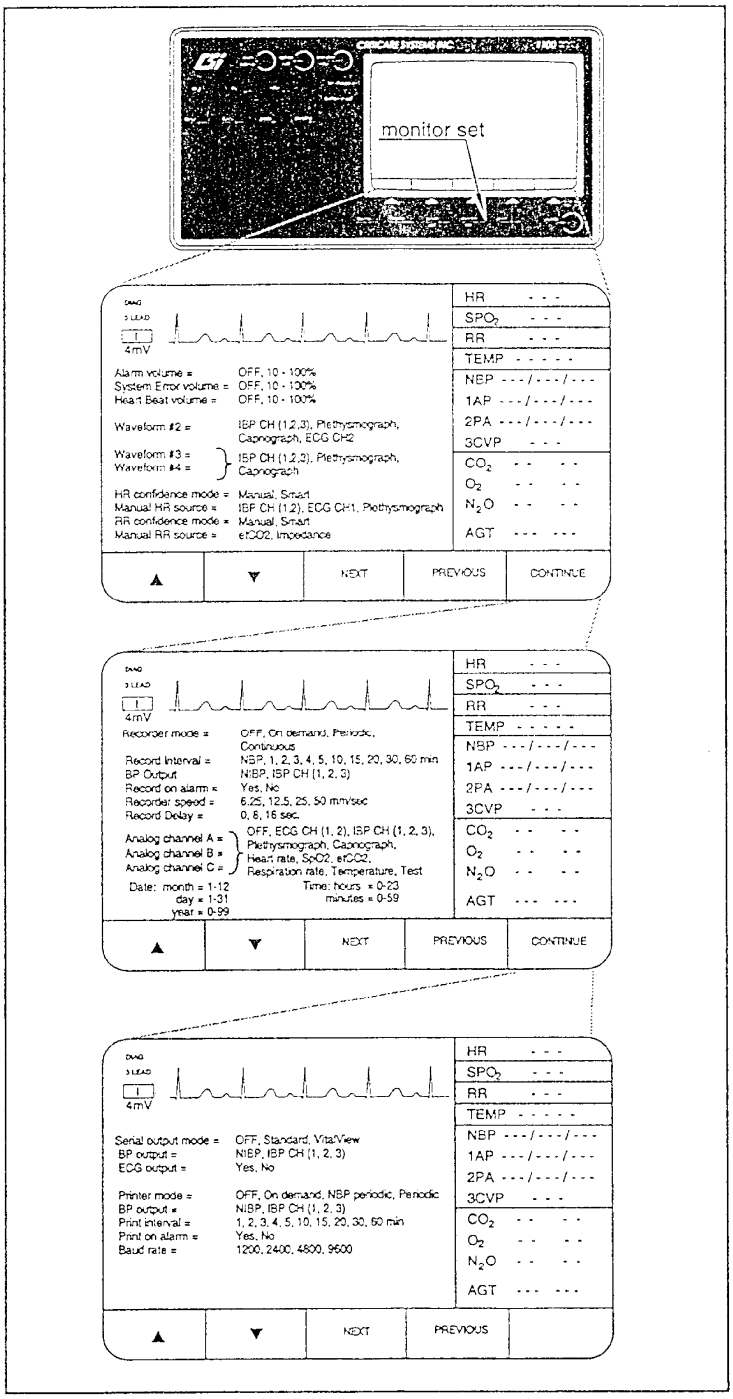
1. Press the monitor set switch. The first screen of the monitor setup menu will appear. (See the figure on page D-2.)
2. Press the CONTINUE softkey to move to the second screen of the monitor setup parameters. The second screen contains the setup parameters for the strip chart recorder.
3. Press CONTINUE again to move to the third screen of the monitor setup parameters. The parameters on this screen control the serial and printer outputs.
4. Press the NEXT and PREVIOUS softkeys until the parameter to be changed is highlighted.
5. Press the ▲ and ▼ softkeys until the desired setting for that parameter is displayed on the screen.

Serial Output

The serial output provides RS-232 data packets that contain the following patient data:

- ECG waveform
- Heart rate
- SpO2
- Respiration rate
- Temperature
- NIBP
- IBP channels 1 through 3
- Inspired and expired CO_2, N_2O, O_2, and Agent
- Analog output ID
- Month, date, year; hours, minutes, seconds
- All alarm limits

Serial Output (cont.)



Serial Output (cont.)

The contents of each of these data packets is described in **Appendix E -- 1100 Communication Protocol for RS-232 Output** in this manual.

The serial output can be connected to a VitalView™ System or to a computer.

The serial output is taken from a DB-9 connector located on the rear panel. The connector is labeled COMPUTER/INTERFACE.

Note that the BP output and ECG output can be menu-selected. In standard serial output mode, all four BP channels are output regardless of which BP channel is selected. The ECG output can be turned on or off.

In VitalView™ serial output mode, only the selected BP output is transmitted. The ECG is always transmitted whether the selected ECG output is on or off.

Pin Designations

The following are the pin designations of the output ports on the back of the 1100 monitor.

Strip Chart Recorder

The connections at the strip chart recorder connector are as follows:

1100 Pin #	Description	Function
pin 1	RS232IN	Receives data from the 1120 strip chart recorder
pin 2	RS232OUT	Transmits data to the 1120 strip chart recorder
pin 3	DAC0	Digitized analog output channel 0
pin 4	DAC1	Digitized analog output channel 1
pin 5	DAC2	Digitized analog output channel 2
pin 6 - 9	Common	Ground

Strip Chart Recorder (cont.)

CABLE CONFIGURATION

The cable used to connect the strip chart recorder to the 1100 should be configured as follows:

1100 Pin #	Strip Chart Recorder Pin #
1	1
2	2
3	4
4	3
5	5
8	8
9	9

Both ends of the cable are male DB-9 connectors. This cable is available as CSI catalog number 1107.

Printer

The connections at the 1100 printer output connector (the unmarked DB-15 connector) are as follows.

1100 Pin #	Description	Function
pin 1	RS232IN	Receives data from the external printer
pin 2	RS232OUT	Transmits data to the external printer
pin 3	DAC0	Analog output* (channel A)
pin 4	DAC1	Analog output* (channel B)
pin 5	DAC2	Analog output* (channel C)
pin 6, 7	No connection	No function
pin 8	Audio	Audio output
pins 9-15	Common	Ground

*All analog outputs are 0 - 1 volt.

Printer (cont.)

CABLE CONFIGURATION

The cable used to connect a standard serial printer to the 1100 should be configured as follows:

1100 Pin #	Printer Pin #
1	2
2	3
9	7

The 1100 end of the cable is a male DB-15, and the printer end of the cable is a male DB-25 connector. The serial printer cable is available as CSI catalog number 1108.

Computer Interface

The connections at the 1100 COMPUTER INTERFACE connector are as follows.

1100 Pin #	Description	Function
pins 1, 6, 9	No connection	No function
pin 2	RS232IN	Receives data from the PC
pin 3	RS232OUT	Transmits data to the PC
pin 4	+12V	Power
pin 5	Common	Ground
pin 7	RS232 CTS	Serial "clear to send"
pin 8	RS232 RTS	Serial "request to send"

CABLE CONFIGURATION

The cable used to connect the computer to the 1100 should be configured as follows:

1100 Pin #	Computer Pin # (DB-25)	Computer Pin # (DB-9)
2	3	2
3	2	3
5	7	5

An RS232-type cable (not included) is used to connect the 1100 to the serial port of a PC. The end of the cable connecting to the 1100 terminates in a male DB-9 connector. The PC end of the cable may have a female DB-9 or DB-25 connector. (Consult the PC operator's manual for the serial interface specifications and cable pinouts.)

External Monitor

The connections at the 1100 EXTERNAL MONITOR port are as follows.

1100 Pin #	Description	Function
pins 1, 2	Common	Ground
pin 3-6	No connection	No function
pin 7	Video	Video signal
pin 8	HSYNC	Horizontal video sync
pin 9	VSYNC	Vertical video sync signal

CABLE CONFIGURATION

The cable used to connect the computer to the external monitor should be configured as follows:

1100 Pin #	Computer Pin #
1	1
2	2
7	7
8	8
9	9

The 1100 end of the cable is a male DB-9 connector, and the external monitor end of the cable is a male DB-9 connector.

Appendix E — 1100 Communication Protocol (for RS-232 Output)

April 1, 1992

The 1100 RS232 communication protocol allows the transmission of the current values of physiological parameters, errors, alarms, and other parameters. All data packets are transmitted at a 1Hz rate. ECG waveform packets are transmitted at 60Hz, and are derived from a 300Hz sample rate.

Data packets are transmitted as follows:

Baud rate: 9600
Start bit: 1
Data bits: 8
Stop bit:1
Parity: None

All data packets are in ASCII code with the exception of the ECG waveform packet, which contains binary values. The following control characters are utilized:

<SOH>	01h	Start of header
<LF>	0Ah	Line feed
<CR>	0Dh	Carriage return
<DC1>	11h	Device control 1
<DC3>	13h	Device control 3

All packets are fixed length, beginning with <SOH> and ending with <CR><LF>.

The current value of a parameter may be displayed in any of the following three ways:

3x3x3x	Numeric value (ASCII 3xh) of the parameter.
	Blank (ASCII 20h) when the paramter is off or not responding.
———	Dashes (ASCII 2dh) when the parameter is invalid.

PACKETS SENT FROM 1100 TO HOST COMPUTER

ECG WAVEFORM

Identifier: W
Bytes: 10
Example: <SOH>W xx xx xx xx xx xx <CR><LF>

Byte 1: W Identifier

Byte 2: xx Phase and ECG gain number, 90h - C4h:

Bits 0-3: Phase number:

0	Phase 0
1	Phase 1
2	Phase 2
3	Phase 3
4	Phase 4

Bits 4-6: ECG gain:

1	1/2 mv/cm
2	1 mv/cm
3	2 mv/cm
4	4 mv/cm

Bit 7: Always set to 1

Bytes 3-7: xx Binary waveform values, phases 0 - 4. The waveform data has 8 bit resolution, and will have a value from 0h to FFh.

	Phase 0	Phase 1	Phase 2	Phase 3	Phase 4
sample #	1	2	3	4	5
sample #	6	7	8	9	10
sample #	11	12	13	14	15
sample #	16	17	18	19	20
sample #	21	22	23	24	25

HEART RATE

Identifier: H
Bytes: 10
Example: <SOH>H 3x 3x 3x 3x3x3x <CR><LF>

Byte 1: H Identifier

Byte 2: 3x Heart rate source:

1	ECG
2	Invasive Ch1
3	Invasive Ch2
4	SpO2

Byte 3: 3x Errors:

0	No errors
1	RA ECG ELECTRODE OFF
2	LA ECG ELECTRODE OFF
3	RL ECG ELECTRODE OFF
4	LL ECG ELECTRODE OFF
5	C ECG ELECTRODE OFF
6	ALL ECG ELECTRODES OFF
7	ECG NOT RESPONDING

Byte 4: 3x Alarms:

0	No alarms
1	HR high alarm
2	HR low alarm
3	Asystole alarm
4	
5	HR lost alarm

Byte 5-7: 3x3x3x Heart rate (beats/minute)

SpO2

Identifier: O
Bytes: 8
Example: <SOH>O 3x 3x 3x3x <CR><LF>

Byte 1: O Identifier

Byte 2: 3x Errors:

0	No errors
1	Check SpO_2 SENSOR SITE
2	SpO_2 HIGH AMBIENT
3	SpO_2 PULSE AMPLITUDE LOW
4	SpO_2 PULSE SEARCH
5	OXIMETER NOT RESPONDING
6	SENSOR MISSING

Byte 3: 3x Alarms:

0	No alarms
1	High alarm
2	Low alarm

Byte 4-5: 3x3x Pulse oxygen (%)

RESPIRATION RATE

Identifier: R
Bytes: 9
Example: <SOH>R 3x 3x 3x 3x3x <CR><LF>

Byte 1: R Identifier

Byte 2: 3x Respiration rate source
- 0 None
- 1 ECG Impedance
- 2 EtCO2

Byte 3: 3x Errors:
- 0 No errors

Byte 4: 3x Alarms:
- 0 No alarms
- 1 High alarm
- 2 Low alarm
- 3 Apnea alarm

Byte 5-6: 3x3x Respiration rate (Breaths/min)

TEMPERATURE

Identifier: T
Bytes: 11
Example: <SOH>T 3x 3x 3x3x3x.3x <CR><LF>

Byte 1: T Identifier

Byte 2: 3x Errors:
- 0 No errors
- 1 NO TEMPERATURE PROBE

Byte 3: 3x Alarms:
- 0 No alarms
- 1 High alarm
- 2 Low alarm

Byte 4-8: 3x3x3x.3x Temperature in degrees F or C

NON-INVASIVE BLOOD PRESSURE 1

Identifier: N
Bytes: 10
Example: <SOH>N 1 3x3x:3x3x <CR><LF>

Byte 1: N Identifier

Byte 2: 1 Packet #1

Byte 3-7: 3x3x:3x3x Minutes & seconds since last reading

NON-INVASIVE BLOOD PRESSURE 2

Identifier: N
Bytes: 10
Example: <SOH>N 2 3x3x 3x 3x 3x <CR><LF>

Byte 1: N Identifier

Byte 2: 2 Packet #2

Byte 3-4: 3x3x Errors:

0	No errors
1	NIBP CUFF/HOSE LEAK
2	CHECK NIBP CUFF
3	NIBP EXCESSIVE MOTION
4	NIBP REINFLATION
5	NIBP IRREGULAR PULSE
6	NIBP NOISY PULSE
7	NIBP EXCEEDED MAX TIME
8	NIBP EXCEEDED MAX PULSES
9	NIBP EXCEEDED MAX PRESS
10	NIBP PULSE AMPLITUDE LOW
11	NIBP CUFF DISCONNECTED
12	NIBP NOT RESPONDING

Byte 5: 3x Systolic alarms:

0	No alarms
1	High systolic
2	Low systolic

Byte 6: 3x Diastolic alarms:

0	No alarms
1	High diastolic
2	Low diastolic

Byte 7: 3x Mean alarms:

0	No alarms
1	High mean
2	Low mean

NON-INVASIVE BLOOD PRESSURE 3

Identifier: N
Bytes: 11
Example: <SOH>N 3 3x3x3x 3x3x3x <CR><LF>

Byte 1: N Identifier

Byte 2: 3 Packet #3

Byte 3-5: 3x3x3x Systolic pressure (mmHg)
Byte 6-8: 3x3x3x Diastolic pressure (mmHg)

NON-INVASIVE BLOOD PRESSURE 4

Identifier: N
Bytes: 8
Example: <SOH>N 4 3x3x3x <CR><LF>

Byte 1: N Identifier

Byte 2: 4 Packet #4

Byte 3-5: 3x3x3x Mean pressure (mmHg)

INVASIVE BLOOD PRESSURE 1

Identifier: I
Bytes: 11
Example: <SOH>I 1 3x 3x 3x 3x 3x 3x <CR><LF>

Byte 1: I Identifier

Byte 2: 1 Packet #1

Byte 3: 3x Invasive channel identifier:
- 1 Channel 1
- 2 Channel 2
- 3 Channel 3

Byte 4: 3x Type of measurement:
- 1 Arterial (AP)
- 2 Pulmonary (PA)
- 3 Central venous (CVP)
- 4 Intracranial (ICP)

Byte 5: 3x Errors:

0	No errors
1	INVALID XDUCER ZERO
2	PULSE AMPLITUDE LOW
3	XDUCER MISSING
4	ZERO XDUCER
5	BP HARDWARE ERROR
6	BP NOT RESPONDING

Byte 6: 3x Systolic alarms:

0	No alarms
1	High systolic
2	Low systolic

Byte 7: 3x Diastolic alarms:

0	No alarms
1	High diastolic
2	Low diastolic

Byte 8: 3x Mean alarms:

0	No alarms
1	High mean
2	Low mean

INVASIVE BLOOD PRESSURE 2

Identifier: I
Bytes: 11
Example: <SOH>I 2 3x3x3x 3x3x3x <CR><LF>

Byte 1: I Identifier

Byte 2: 2 Packet #2

Byte 3-5: 3x3x3x Systolic pressure (mmHg)
Byte 6-8: 3x3x3x Diastolic pressure (mmHg)

INVASIVE BLOOD PRESSURE 3

Identifier: I
Bytes: 8
Example: <SOH>I 3 3x3x3x <CR><LF>

Byte 1: I Identifier

Byte 2: 3 Packet #3

Byte 3-5: 3x3x3x Mean pressure (mmHg)

GASES 1

Identifier: G
Bytes: 11
Example: <SOH>G 1 3x 3x 3x3x 3x 3x <CR><LF>

Byte 1: G — Identifier

Byte 2: 1 — Packet #1

Byte 3: 3x — Specific gas identifier:

0	Unknown
1	CO2 - Carbon dioxide
2	O2 - Oxygen
3	N2O - Nitrous oxide
4	Unknown agent
5	Halothane
6	Enflurane
7	Isoflurane
8	Sevoflurane

Byte 4: 3x — Units:

1	Millimeters of mercury (mmHg)
2	Kilopascals (kPa)
3	Percent (%)

Byte 5-6: 3x3x — Errors:

0	None
1	Gas bench failure
2	Gas line occluded
3	Replace water trap
4	Insert water trap
5	Gas bench warming up
6	Gas auto calibration
7	Oxy cell voltage low
8	Oxy cell expired
9	No agent factory cal
10	No agent ID factory cal
11	Low agent signal
12	Low agent ref signal
13	No N2O factory cal
14	Low N2O signal
15	Low N2O ref signal
16	Mixed agents
17	Gas bench comm failure
18	Gas not responding

Byte 7: 3x Inspired alarms:

0	No alarms
1	High inspired
2	Low inspired

Byte 8: 3x Expired alarms:

0	No alarms
1	High expired
2	Low expired

GASES 2

Identifier: G
Bytes: 13
Example: <SOH>G 2 3x3x.3x 3x3x.3x <CR><LF>

Byte 1: G Identifier

Byte 2: 2 Packet #2

Byte 3-6: 3x3x.3x Inspired value
Byte 7-10: 3x3x.3x Expired value

ANALOG OUTPUT

Identifier: A
Bytes: 10
Example: <SOH>A 3x3x 3x3x 3x3x <CR><LF>

Byte 1: A Identifier

Byte 2-3: 3x3x Waveform output on analog channel 1:

0	Off
1	ECG channel 1
2	ECG channel 2
3	Invasive blood pressure channel 1
4	Invasive blood pressure channel 2
5	Invasive blood pressure channel 3
6	Plethysmograph
7	Capnograph
8	Heart rate
9	SpO2
10	etCO2
11	Respiration rate
12	Temperature
13	Test

Byte 4-5:	3x3x		Waveform output on analog channel 2:
		0	Off
		1	ECG channel 1
		2	ECG channel 2
		3	Invasive blood pressure channel 1
		4	Invasive blood pressure channel 2
		5	Invasive blood pressure channel 3
		6	Plethysmograph
		7	Capnograph
		8	Heart rate
		9	SpO2
		10	etCO2
		11	Respiration rate
		12	Temperature
		13	Test
Byte 6-7:	3x3x	Waveform output on analog channel 3:	
		0	Off
		1	ECG channel 1
		2	ECG channel 2
		3	Invasive blood pressure channel 1
		4	Invasive blood pressure channel 2
		5	Invasive blood pressure channel 3
		6	Plethysmograph
		7	Capnograph
		8	Heart rate
		9	SpO2
		10	etCO2
		11	Respiration rate
		12	Temperature
		13	Test

DATE 1

Identifier: D
Bytes: 13
Example: <SOH>D 1 3x3x/3x3x/3x3x <CR><LF>

Byte 1: D	Identifier	
Byte 2:	1	Packet #1
Byte 3-10:	3x3x/3x3x/3x3x	Month/day/year

DATE 2

Identifier: D
Bytes: 13
Example: <SOH>D 2 3x3x:3x3x:3x3x <CR><LF>

Byte 1: D Identifier

Byte 2: 2 Packet #2

Byte 3-10: 3x3x:3x3x:3x3x Hours:minutes:seconds

ALARM LIMITS 1

Identifier: L
Bytes: 11
Example: <SOH>L 1 3x3x3x 3x3x3x <CR><LF>

Byte 1: L Identifier

Byte 2: 1 Packet #1

Byte 3-5: 3x3x3x HR high
Byte 6-8: 3x3x3x HR low

ALARM LIMITS 2

Identifier: L
Bytes: 9
Example: <SOH>L 2 3x3x 3x3x <CR><LF>

Byte 1: L Identifier

Byte 2: 2 Packet #2

Byte 3-4: 3x3x SpO2 high Byte 5-6: 3x3x SpO2 low

ALARM LIMITS 3

Identifier: L
Bytes: 11
Example: <SOH>L 3 3x3x3x 3x3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	3	Packet #3
Byte 3-5:	3x3x3x	AP/NIBP systolic high
Byte 6-8	3x3x3x	AP/NIBP systolic low

ALARM LIMITS 4

Identifier: L
Bytes: 11
Example: <SOH>L 4 3x3x3x 3x3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	4	Packet #4
Byte 3-5:	3x3x3x	AP/NIBP diastolic high
Byte 6-8:	3x3x3x	AP/NIBP diastolic low

ALARM LIMITS 5

Identifier: L
Bytes: 10
Example: <SOH>L 5 3x3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	5	Packet #5
Byte 3-5:	3x3x3x	AP/NIBP mean high
Byte 6-7:	3x3x	AP/NIBP mean low

ALARM LIMITS 6

Identifier: L
Bytes: 9
Example: <SOH>L 6 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	6	Packet #6
Byte 3-4:	3x3x	PA systolic high
Byte 5-6:	3x3x	PA systolic low

ALARM LIMITS 7

Identifier: L
Bytes: 9
Example: <SOH>L 7 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	7	Packet #7
Byte 3-4:	3x3x	PA diastolic high
Byte 5-6:	3x3x	PA diastolic low

ALARM LIMITS 8

Identifier: L
Bytes: 9
Example: <SOH>L 8 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	8	Packet #8
Byte 3-4:	3x3x	PA mean high
Byte 5-6:	3x3x	PA mean low

ALARM LIMITS 9

Identifier: L
Bytes: 9
Example: <SOH>L 9 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	9	Packet #9
Byte 3-4:	3x3x	CVP/ICP high
Byte 5-6:	3x3x	CVP/ICP low

ALARM LIMITS 10

Identifier: L
Bytes: 9
Example: <SOH>L A 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	A	Packet #A
Byte 3-4:	3x3x	RR high
Byte 5-6:	3x3x	RR low

ALARM LIMITS 11

Identifier: L
Bytes: 10
Example: <SOH>L B 3x3x3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	B	Packet #B
Byte 3-7:	3x3x3x.3x	Temperature high

ALARM LIMITS 12

Identifier: L
Bytes: 10
Example: <SOH>L C 3x3x3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	C	Packet #C
Byte 3-7:	3x3x3x.3x	Temperature low

ALARM LIMITS 13

Identifier: L
Bytes: 9
Example: <SOH>L D 3x3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	D	Packet #D
Byte 3-6:	3x3x.3x	Inspired CO2 high

ALARM LIMITS 14

Identifier: L
Bytes: 13
Example: <SOH>L E 3x3x.3x 3x3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	E	Packet #E
Byte 3-6:	3x3x.3x	etCO2 high
Byte 7-10:	3x3x.3x	etCO2 low

ALARM LIMITS 15

Identifier: L
Bytes: 9
Example: <SOH>L F 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	F	Packet #F
Byte 3-4:	3x3x	Inspired O2 high
Byte 5-6:	3x3x	Inspired O2 low

ALARM LIMITS 16

Identifier: L
Bytes: 9
Example: <SOH>L G 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	G	Packet #G
Byte 3-4:	3x3x	Expired O2 high
Byte 5-6:	3x3x	Expired O2 low

ALARM LIMITS 17

Identifier: L
Bytes: 9
Example: <SOH>L H 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	H	Packet #H
Byte 3-4:	3x3x	Inspired N2O high
Byte 5-6:	3x3x	Inspired N2O low

ALARM LIMITS 18

Identifier: L
Bytes: 9
Example: <SOH>L I 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	I	Packet #I
Byte 3-4:	3x3x	Expired N2O high
Byte 5-6:	3x3x	Expired N2O low

ALARM LIMITS 19

Identifier: L
Bytes: 11
Example: <SOH>L J 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	J	Packet #J
Byte 3-5:	3x.3x	Inspired agent high
Byte 6-8:	3x.3x	Inspired agent low

ALARM LIMITS 20

Identifier: L
Bytes: 11
Example: <SOH>L K 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	K	Packet #K
Byte 3-5:	3x.3x	Expired agent high
Byte 6-8:	3x.3x	Expired agent low

ALARM LIMITS 21

Identifier: L
Bytes: 11
Example: <SOH>L L 3x3x 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	L	Packet #L
Byte 3-4:	3x3x	Apnea seconds
Byte 5-6:	3x3x	Asystole seconds

ALARM LIMITS 22

Identifier: L
Bytes: 11
Example: <SOH>L M 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	M	Packet #M
Byte 3-5:	3x.3x	Inspired Halothane high
Byte 6-8:	3x.3x	Inspired Halothane low

ALARM LIMITS 23

Identifier: L
Bytes: 11
Example: <SOH>L N 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	N	Packet #N
Byte 3-5:	3x.3x	Expired Halothane high
Byte 6-8:	3x.3x	Expired Halothane low

ALARM LIMITS 24

Identifier: L
Bytes: 11
Example: <SOH>L O 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	O	Packet #O
Byte 3-5:	3x.3x	Inspired Enflurane high
Byte 6-8:	3x.3x	Inspired Enflurane low

ALARM LIMITS 25

Identifier: L
Bytes: 11
Example: <SOH>L P 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	P	Packet #P
Byte 3-5:	3x.3x	Expired Enflurane high
Byte 6-8:	3x.3x	Expired Enflurane low

ALARM LIMITS 26

Identifier: L
Bytes: 11
Example: <SOH>L Q 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	Q	Packet #Q
Byte 3-5:	3x.3x	Inspired Isoflurane high
Byte 6-8:	3x.3x	Inspired Isoflurane low

ALARM LIMITS 21

Identifier: L
Bytes: 11
Example: <SOH>L L 3x3x 3x3x 3x3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	L	Packet #L
Byte 3-4:	3x3x	Apnea seconds
Byte 5-6:	3x3x	Asystole seconds

ALARM LIMITS 22

Identifier: L
Bytes: 11
Example: <SOH>L M 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	M	Packet #M
Byte 3-5:	3x.3x	Inspired Halothane high
Byte 6-8:	3x.3x	Inspired Halothane low

ALARM LIMITS 23

Identifier: L
Bytes: 11
Example: <SOH>L N 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	N	Packet #N
Byte 3-5:	3x.3x	Expired Halothane high
Byte 6-8:	3x.3x	Expired Halothane low

ALARM LIMITS 24

Identifier: L
Bytes: 11
Example: <SOH>L O 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	O	Packet #O
Byte 3-5:	3x.3x	Inspired Enflurane high
Byte 6-8:	3x.3x	Inspired Enflurane low

ALARM LIMITS 25

Identifier: L
Bytes: 11
Example: <SOH>L P 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	P	Packet #P
Byte 3-5:	3x.3x	Expired Enflurane high
Byte 6-8:	3x.3x	Expired Enflurane low

ALARM LIMITS 26

Identifier: L
Bytes: 11
Example: <SOH>L Q 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	Q	Packet #Q
Byte 3-5:	3x.3x	Inspired Isoflurane high
Byte 6-8:	3x.3x	Inspired Isoflurane low

ALARM LIMITS 27

Identifier: L
Bytes: 11
Example: <SOH>L R 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	R	Packet #R
Byte 3-5:	3x.3x	Expired Isoflurane high
Byte 6-8:	3x.3x	Expired Isoflurane low

ALARM LIMITS 28

Identifier: L
Bytes: 11
Example: <SOH>L S 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	S	Packet #S
Byte 3-5:	3x.3x	Inspired Sevoflurane high
Byte 6-8:	3x.3x	Inspired Sevoflurane low

ALARM LIMITS 29

Identifier: L
Bytes: 11
Example: <SOH>L T 3x.3x 3x.3x <CR><LF>

Byte 1:	L	Identifier
Byte 2:	T	Packet #T
Byte 3-5:	3x.3x	Expired Sevoflurane high
Byte 6-8:	3x.3x	Expired Sevoflurane low