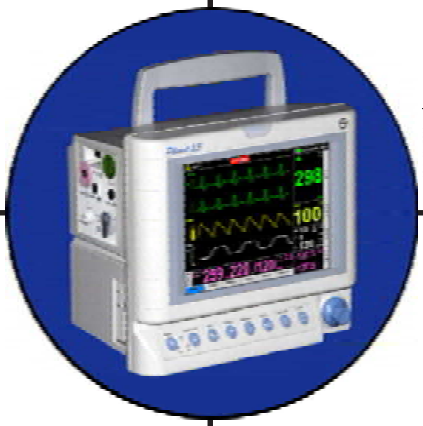

LARSEN & TOUBRO LIMITED

Planet 55

Operating Manual

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Planet 55

4 Channel Color Multiparameter Monitor

Operating Manual

CE 0843

CAT NO. : 3-89-020-0007-84 **ISSUED : April 2010 Rev. :06**

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Introduction

Congratulations on becoming one of the proud customers of L&T Medical's multiparameter color monitor ***Planet 55***.

Planet 55 offers continuous monitoring for ECG (3/5 lead), Respiration, Temperature, Non-Invasive Blood Pressure, Pulse Oximetry and Optional Capnography (microstream) with an inbuilt two-channel thermal array recorder which can record on-line data (any two waveform out of ECG waveform, plethysmograph and respiration/capnography along with numerical values of all parameters).

Planet 55 is a four channel monitor except incase of AAMI with selectable waveform display facility for ECG Cascade, Respiration waveform, Plethysmograph and Capnograph. It also displays the digital values of HR/PR, SpO_2, Respiration Rate, Non-Invasive Blood Pressure (Systolic, Diastolic and Mean), Temperature and CO_2 ($EtCO_2$ and $FiCO_2$) readings. ***Planet 55*** has graded and color coded alarms. It has the option of 72 hours tabular and graphical trends for 200 patients of ECG (HR/PR), Respiration rate, SpO_2,Temperature and CO_2 ($EtCO_2$ and $FiCO_2$). ***Planet 55*** has special tabular trend for NIBP to store last 240 readings. Alarm recall feature offers storage of last 24 critical alarm conditions.

Planet 55 also has a feature of SD Card (Optional).

Planet 55 has various communication modules for various external connectivity and software upgrade options. ***Planet 55*** also has a connectivity to external printer through USB port (optional). ***Planet 55*** allows the user to print the trend data and last 24 patient related alarm conditions in tabular format.

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Exemptions

L&T's liability under this warranty does not include any transportation damage or other charges or liability for direct, indirect or consequential damages or delay resulting from improper use or application of the product or the substitution upon it of parts or accessories not approved by L&T.

Copyright

Standards

This equipment has been designed to meet the following International standards:
Class 1 equipment requirement of IEC 60601-1.
EMI/EMC requirements as per IEC 60601-1-2.
IEC 60601-2-27 requirements for ECG.
IEC 60601-2-30 requirements for NIBP.
IEC 60601-1-8 requirements for alarm systems.
IEC 60601-2-49 requirements for multifunction patient monitor systems.
ISO 9919 requirements for SpO_2.
ISO 21647 requirements for CO_2.
AAMI EC 13 for ECG.
AAMI SP 10 for NIBP.

Disposal Instructions

- Follow the local regulations and procedures for the disposal of the unit and battery.

Read all the Cautions, Warnings and Notes provided throughout the Operating Manual before using the monitor.

Caution

Cautions are intended to alert you to the importance of following correct operating procedures to prevent the risk of damage to the system.

- Electrical installation of the room or the building in which the equipment is to be used, should comply with regulations specified by the country in which the equipment is to be used.
- If earthing arrangements are suspected, the monitor must be connected to a mains line with proper earth connection to ensure correct readings.
- The equipment should be used in accordance with the "instruction for use" provided by L&T and as specified on the rear panel of the monitor.
- If any function of the monitor fails, then consult L&T Medical authorized service engineer.
- Failure to meet ventilation requirement may cause equipment failure and intern jeopardise the functions of automated monitoring. Do not place equipment in an enclosed area that could restrict heat dissipation from the front or rear of the unit.
- Keep pacemaker patients under close observation. Rate meters may continue to count the pacemaker rate during cardiac arrest and some arrhythmia.
- This equipment is meant for use by qualified medical personnel only.
- For the disposal of battery after its life, follow the local regulations and procedures.
- Use L&T approved Accessories and Batteries.

WARNING

WARNINGs are intended to alert you to the importance of following correct operating procedures where risk of injury to the patient or system user exists.

- All modifications and repairs should be carried out by authorized L&T personnel or authorized agents.
- Alarms:
  Adjusting the alarm volume to a low level or switching OFF alarms during patient monitoring may result in alarm conditions going unnoticed. Hence do not rely fully on audible alarm.
  The most reliable method of patient monitoring combines close personal surveillance with correct operation of monitoring equipment.
- After AC power is resumed keep the monitor ON for 16 hours to charge the battery, if low battery indicator is displayed.
- When 'low battery' indication comes on screen, connect the unit to main supply and keep the unit for charging.
- Use only L&T approved accessories and batteries.
- Do not use damaged cables/sensors, cuffs and contaminated accessories.
- When several equipment of different companies/makes are interconnected through the same mains power distribution line, the summation of the resulting leakage currents may exceed the maximum limits.
- Explosion hazards are possible if used in the presence of flammable anesthetics.
- For continued protection against fire hazard, use fuses of only specified type and rating.
- 'Electrical shock hazard'. Do not remove cover. Refer to qualified personnel for servicing.
- Patient safety and performance of this unit when connected to patients undergoing magnetic resonance diagnostic procedures is unknown. We advice that all sensors and cables used with this unit should be removed from patient during such procedures.
- L&T medical does not assume responsibility for damage to the equipment caused by improperly ventilated cabinets, improper or faulty power or insufficient wall strength incase of wall mounted units.
- Do not use the machine with nuclear spin tomography (MRT, NMR, NMT) as the function of the machine may be disturbed.
- Pay extra attention if the parts of the equipment are provided with protections against burning the patient when used with High Frequency (HF) surgical equipment.
- Observe extreme caution when a defibrillator is used on a patient. Do not touch any part of patient, table or monitor when a defibrillator is in use.

Unpacking

Check for any signs of transportation damage after removing the Patient Monitor from the packing carton. Verify the material in the packing carton as per the packing list sent along with the monitor.

Preserve the packing carton as it may required/useful for future use.

Indication For Use

The *Planet 55* multiparameter Patient Monitoring system is intended to monitor a single adult, pediatric or neonatal patient's vital signs at the bedside or during Intra-hospital transport along with the appropriate accessories mentioned / supplied with the unit. Vital signs parameters include ECG (3 lead / 5 lead), SpO_2, Respiration, Temperature and Capnography (CO_2). It can also display the digital values of HR/PR, SpO_2, RR, Non-Invasive Blood Pressure (Systolic, Diastolic and Mean), Temperature, $EtCO_2$ and $FiCO_2$ readings.

The user, responsible to interpret the monitored data made available, will be a professional health care provider. The device permits patient monitoring with adjustable alarm limits as well as visible and audible alarm signals. The monitor is not intended for home use.

Handling Precautions

This monitor is intended for use by only qualified medical personnel and a monitor is restricted to one patient at a time.

Please read these precautions thoroughly before attempting to operate this monitor.

1. **To satisfactorily and effectively use monitor, its operation must be fully understood.**

2. **While installing or storing the monitor, take the following precautions.**
   - Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and dusty air.
   - The monitor should be placed on an even, level floor. Vibration and mechanical shock should be avoided even during moving.
   - Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
   - The power line source to be applied to the monitor should correspond in frequency and voltage to specifications, and have allowable current capacity.

3. **Before Operation**
   - Check that the monitor is in perfect operating order.
   - Check that the monitor is grounded properly.
   - Check that all accessories are connected properly.
   - Pay extra attention when the monitor is in combination with other instruments to avoid misdiagnosis or other problems.
   - All circuitry used for direct patient connection must be doubly checked.
   - Check that the unit is not indicating low battery.

4. **During Operation**
   - Both the monitor and the patient must receive constant, careful attention.
   - Turn power OFF or remove electrodes and cables when necessary to assure the patient's safety.
   - Avoid direct contact between the monitor and the patient.
   - Extra care should be taken when the monitor is in use with the HF Surgical Equipment.

Note

The applied parts of NIBP and CO_2 are protected against HF surgical burns and the applied parts of ECG, SpO_2 and Temperature are not protected.

5. **To Shutdown After Use**
   - Turn power OFF with all controls returned to their original positions.
   - Remove all accessories gently, do not use force to remove them.

Symbols

	Logo
~	Mains 110 / 230 Volts ON indicator
⊙	Unit ON indicator
	Equipotential ground
⚠	Attention, refer to manual
	Defibrillation – Proof type-CF of Applied Part
	Defibrillation – Proof type-BF of Applied Part
	Global Alarm suspended
	Alarm Acknowledge
♥	Indicates valid QRS/Pulse detection
*	Indicates detection of PR from Plethysmograph
#	Indicates detection of PR from NIBP
$	Indicates detection of PR from IBP
	Manufacturer
EC REP	Authorised representative in the european community

Symbols

	Monitor ON/OFF
	NIBP measurement Start/Stop
	Recorder ON/OFF
	Freeze / Defreeze
	Goto
	Stand By
	Home
	CO_2 Pump
	NIBP Trend
	ECG Lead selection
	ECG Gain adjustment
	Display Format selection
	Beep and Alarm Volume adjustment
PR SOURCE	PR Source selection
	NIBP Timer
	Left Navigator
	Selection Key
	Right Navigator

Abbreviations

SpO_2	Oxygen Saturation in %
HR	Heart Rate (derived from ECG)
BPM	Beats Per Minute (HR/PR)
BPM	Breaths Per Minute (RR)
FLT	Fault
SYS	Systolic Blood Pressure
DIA	Diastolic Blood Pressure
MEAN	Mean Blood Pressure
PR	Pulse Rate
RR	Respiration Rate
$EtCO_2$	End Tidal Carbon dioxide
$FiCO_2$	Fractional Inspired Carbon dioxide
DPI	Dot Per Inch
CNS	Central Nursing Station
PA	Physiological Alarm
TA	Technical Alarm
CIC	Communication Interface Card
NA	No Alarm

1

DISPLAY, CONTROLS, CONNECTIONS AND OUTPUTS

Notes:

Front Panel

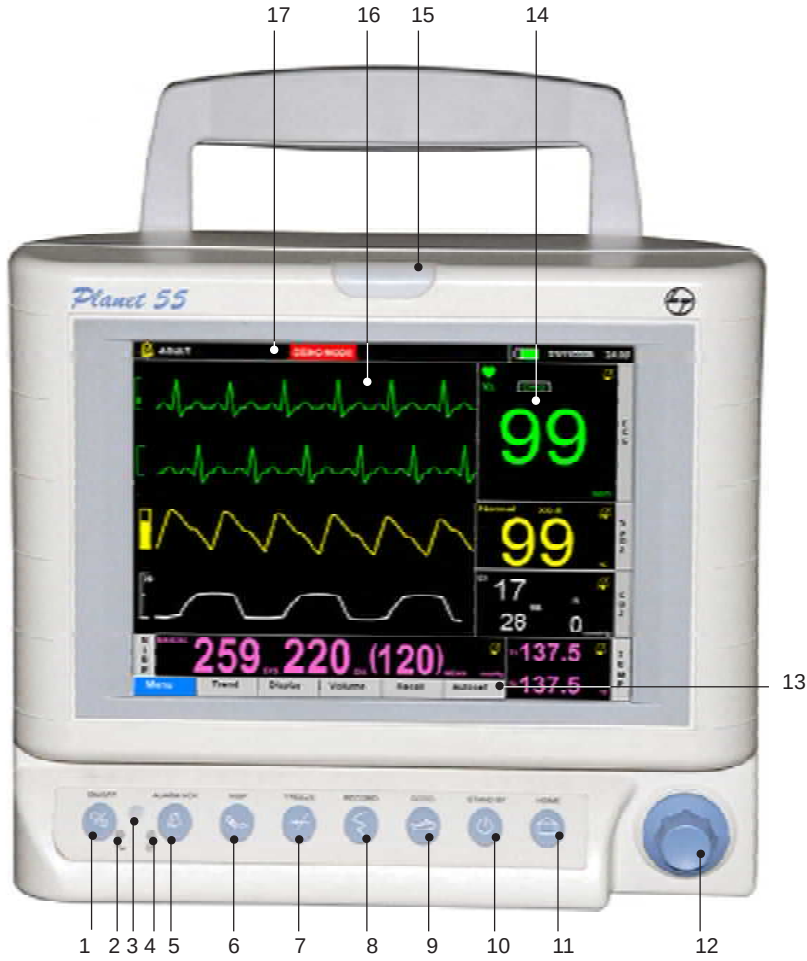


Figure 1.1

Front Panel Description

1	Monitor ON/OFF switch	To switch ON or switch OFF the monitor (Unit should be connected to the mains supply or to the internal battery).
2	Mains Indicator	Amber color LED turns ON when Mains is connected.
3	Remote sensor	To sense the remote signals.
4	Monitor ON indicators	Amber LED ON indicates Mains ON. Green LED ON indicates Monitor ON. Amber LED OFF and Green LED ON indicates unit is ON in battery operation mode.
5	Alarm Acknowledge	On pressing this key, all audio alarms are muted or suspended. When Audio/Visual alarms are indicated by the unit, this key acts as alarm acknowledge key.
6	NIBP Start/Stop	This key is used to start/stop the Auto/Manual NIBP measurement.
7	Freeze/Defreeze	To Freeze / Defreeze the screen, this key is used.
8	Record	To Start / Stop recorder.
9	Goto	This key used as a short cut key for Menu option.
10	Stand By	This key is used for the monitor to go to stand by mode. Press again this key to monitor real time screen. Stand By mode is a power saving option.
11	Home	To come back directly to the Main screen, from any other screen.
12	Optical Encoder	This is a special rotating knob used for multipurpose applications. Rotating the Optical Encoder in clockwise or anti-clockwise direction, moves the cursor (highlighted rectangular block) right or left in the Menu area of the screen. Pressing the Optical Encoder selects the particular function.
13	Menu Display Area	Displays Main menus.
14	Parameter/Numeric	Displays numerical values for all parameters which are present.

15	Alarm Indicator	Gives flashing Yellow color indication for cable / accessory related alarms like cable coming off patient and flashing Red color indication for patient related alarms, e.g. when the value of any parameter being monitored goes above or below the set alarm limits. Audio frequency [AAMI 4.1.2.1(i)] : Red alarm: 1.7 kHz Yellow alarm : 1.4 kHz Video frequency : Red alarm : 2 Hz (250ms ON, 250ms OFF) Yellow alarm : 0.5 Hz (1s ON, 1s OFF) Fixed 3 minutes realarm facility is present. Crossed bell indication for alarm silence.
16	Waveform Display Area	Displays waveforms. Maximum 4 channel monitor.
17	Message Display Area	Displays error messages.

Rear Panel

Figure 1.2

Rear Panel Description

	Connector	Function
1	Equipotential Ground	For external grounding.
2	Mains Plug	Connection for 95-265V AC, 50Hz/60Hz ± 5%.
3	CIC	Communication Interface Card.

CIC available in *Planet 55*:

CIC	Connectors
CIC-4	PC Dump + CNS

Usage of the connectors as shown below:

Connector	Description
DB9	PC Dump.
USB	Central Nursing Station.

Left Side Panel

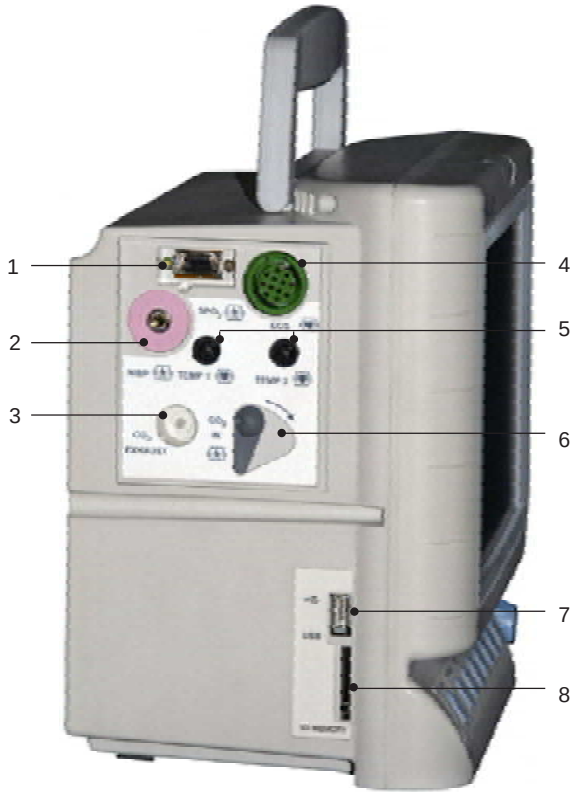


Figure 1.3

Left Side Panel Description

	Connector	Function
1	SpO_2	To interface SpO_2 sensor to the monitor with the help of extension cable.
2	NIBP	To interface NIBP cuff to the monitor with the help of hose tube.
3	CO_2 Exhaust	To vent for CO_2 gas sample.
4	ECG	To interface ECG 3lead or 5lead cable with monitor.
5	TEMP	To interface Temperature probe to the monitor.
6	CO_2	To Input for gas sample.
7	USB	To connect external Printer# (Refer Figure 1.4) / for software upgradation*/ for Trend download*.
8	SD Memory**	To transfer the trend data from one monitor to another.

Figure 1.4

* Use 1GB or 512 MB of Sandisk make.
** Use 1GB, 2GB or 512 MB of Sandisk make.
# Use USB Printer which supports PCL5e and PCL6.

Right Side Panel

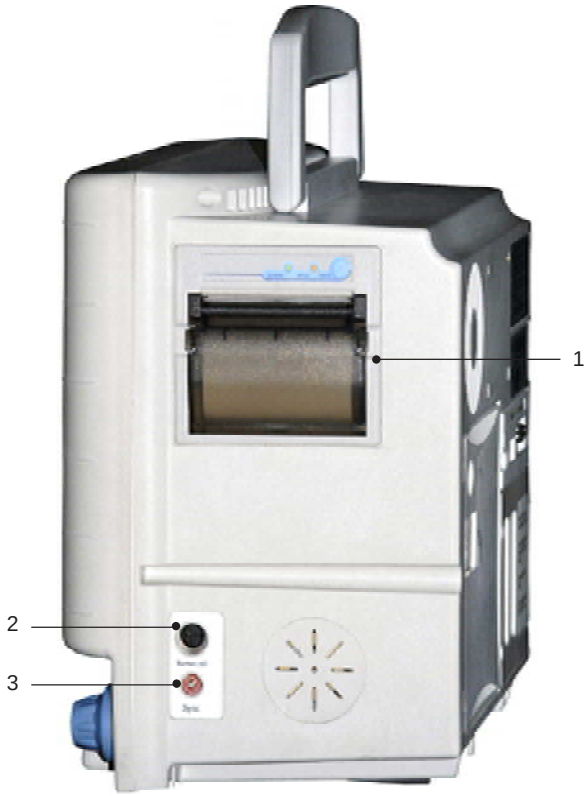


Figure 1.5

Right Side Panel Description

	Connector	Function
1	Recorder	To print the waveform with the digital values.
2	Nurse Call	Configurable relay to activate nurse call.
3	Defib. Sync	For synchronizing monitor with defibrillator.

Procedure To Connect And Disconnect The Connectors

ECG :

Connect	Disconnect
Align the notch of the ECG cable connector with the connector slot on the Side panel with the unit and insert the cable as shown below.	Gently pullout the ECG cable connector as shown below.
	
Figure 1.6	**Figure 1.7**

Temp :

Connect	Disconnect
Insert the Temperature connector in the slot (Temp 1 / Temp 2) provided on the Side panel of the unit as shown below.	Gently pullout the Temperature connector as shown below.
	
Figure 1.8	**Figure 1.9**

NIBP :

Connect	Disconnect
Insert the NIBP connector in the slot provided on the side panel of the unit as shown below.	Press the NIBP connector on the side panel of the unit and remove the connector as shown below.
	
Figure 1.10	**Figure 1.11**

SpO_2 :

Connect	Disconnect
Align the SpO_2 connector with the D-type connector slot on the side panel of the unit and insert as shown below.	Press the release notch of the connector and remove the connector as shown below.
	
Figure 1.12	**Figure 1.13**

CO_2 :

Connect	Disconnect
a) Open the CO_2 inlet shutter in the direction as shown below. b) Insert the CO_2 connector and turn clockwise direction to lock as shown below.	a) Turn the CO_2 connector in anticlockwise direction to unlock as shown below. b) Gently pullout the CO_2 connector as close the inlet shutter.
	
Figure 1.14	**Figure 1.15**

Power cord :

Connect	Disconnect
Insert the Power cord connector in the solt provided on the Rear panel of the unit as shown below.	Gently pullout the Power cord connector as shown below.
	
Figure 1.16	**Figure 1.17**

Grounding cable :

Connect	**Disconnect**
Insert the Grounding cable connector in the slot provided on the Rear panel of the unit as shown below.	Gently pullout the Grounding cable connector as shown below.
	
Figure 1.18	**Figure 1.19**

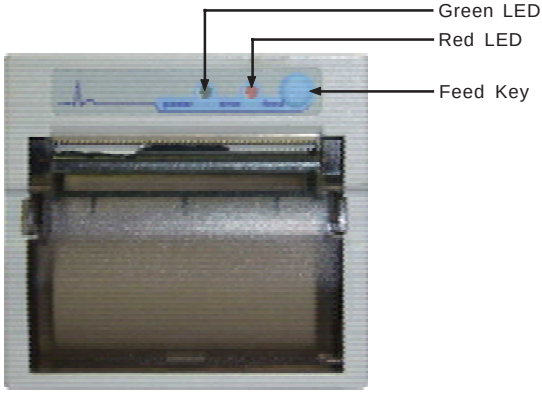


Figure 1.20

	Function
Green LED	Indicates Power ON.
Red LED	It blinks if recorder cover is not properly closed or paper is not present.
Feed Key	Step feeding of paper (approx. 0.5 cm jump)

On-line Recording Output:

i. Delayed recording : Any two waveforms out of ECG, plethysmograph, respiration/capnograph can be selected for recording along with digital values, unit and alarm status of all parameters in Delayed recording.

ii. Trend data recording : The status of any three parameters can be selected for recording in tabular format.

iii. NIBP data recording : The status of NIBP along with any two other parameters can be selected for recording in tabular format.

i. Delayed recording

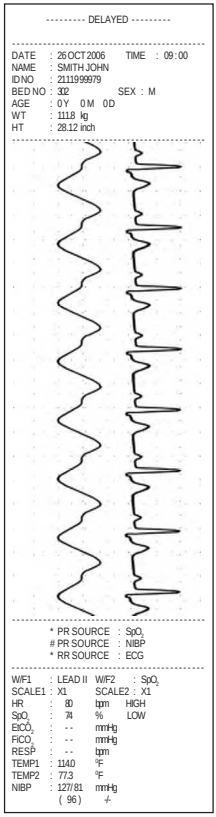


Figure 1.21

ii. Trend data recording

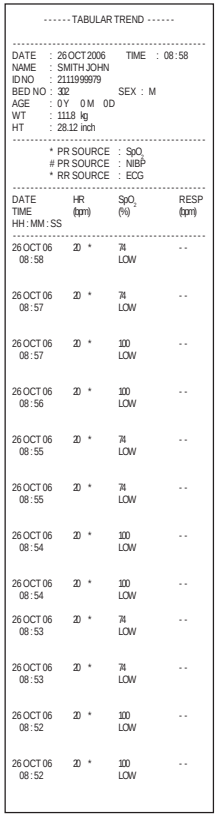


Figure 1.22

iii. NIBP data recording

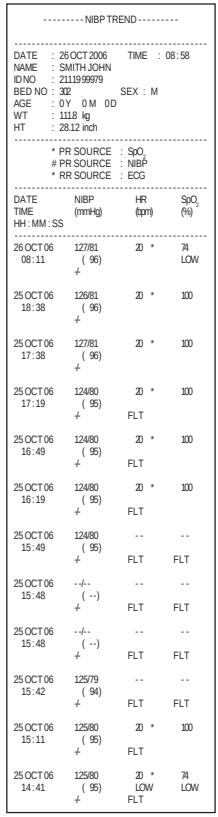


Figure 1.23

Figure 1.24

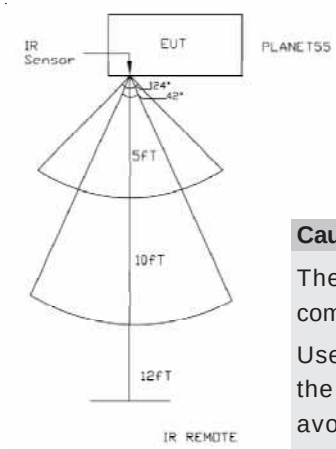
21 hotkeys along with Standby key and an LED is provided on the wireless hand-held remote.

Maximum distance in which the remote can operate is as shown below:

Maximum distance at zero degree to **(remote sensor)** IR detector is 12ft.

Maximum distance at 62 degree to IR detector is 5ft on each side.

Maximum distance at 21 degree to IR detector is 10ft on each side.



Caution

The Remote is based on IR technology and is common for all 55 Series monitors.

Use the Remote in straight line (Preferably) with the remote sensor in the monitor keyboard to avoid changes in other monitors (55 Series) kept nearby.

2

APPLICATION GUIDE

Notes :

Electrode placement (3 lead):

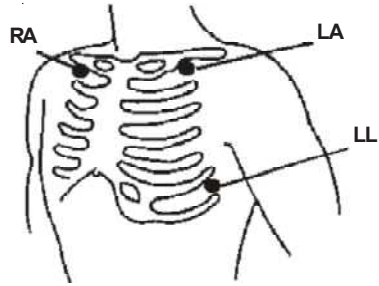
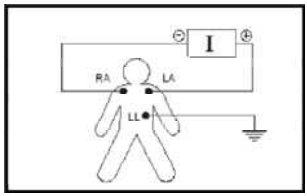


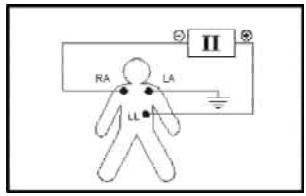
Figure 2.1

Position	Symbol AAMI(IEC)	IEC Colour Coding	AAMI Colour Coding
Right intraclavicular fossa	RA (R)	Red	White
Left intraclavicular fossa	LA (L)	Yellow	Black
Between 6th and 7th intercostal space on the left midclavicular line	LL (F)	Green	Red



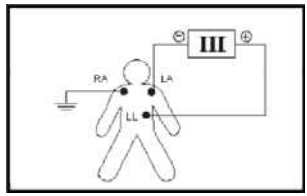
Lead I

Figure 2.2(a)



Lead II

Figure 2.2(b)



Lead III

Figure 2.2(c)

Electrode placement (5 lead)

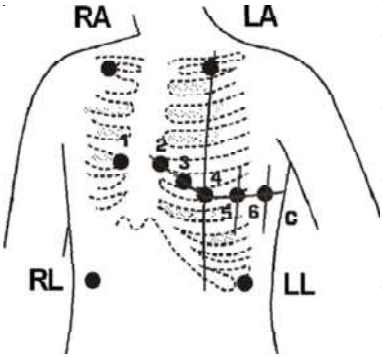


Figure 2.3

Chest electrode positions

C1 (V1) : Fourth intercostal space at the right border of the sternum.

C2 (V2) : Fourth intercostal space at the left border of the sternum.

C3 (V3) : Halfway between C2 (V2) and C4 (V4).

C4 (V4) : Fifth intercostal space of the left midclavicular line.

C5 (V5) : Left anterior axillary line at the same level as C4 (V4).

C6 (V6) : Left midaxillary at the same level as C4 (V4).

Position	Symbol AAMI(IEC)	IEC colour coding	AAMI colour coding
Right intraclavicular fossa	RA (R)	Red	White
Left intraclavicular fossa	LA (L)	Yellow	Black
Between 6th and 7th intercostal space on the left midclavicular line	LL (F)	Green	Red
Between 6th and 7th intercostal space on the right midclavicular line	RL (N)	Black	Green
Any of the chest electrode positions (C1 TO C6)	C1-C6 (V1-V6)	White	Brown

Bipolar Limb Leads

Lead I

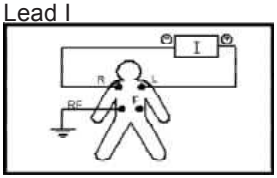


Figure 2.4(a)

Lead II

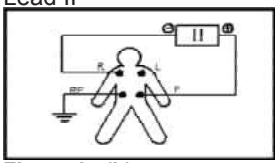


Figure 2.4(b)

Lead III

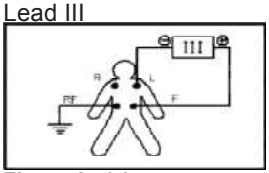


Figure 2.4(c)

Unipolar Limb Leads

Lead aVr

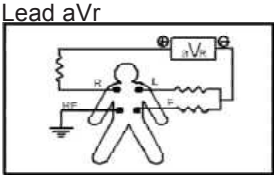


Figure 2.5(a)

Lead aVl

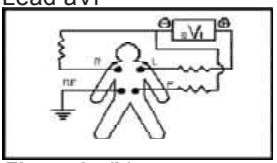


Figure 2.5(b)

Lead aVf

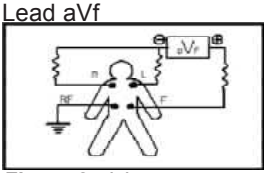


Figure 2.5(c)

Unipolar Chest Leads

Lead V1-6

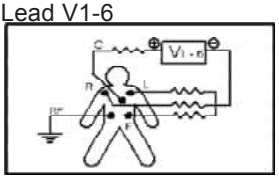


Figure 2.6

Note

- Place the electrodes on the patient before the electrode cable is plugged into the monitor.
- Special consideration should be given to electrode placement when an electrosurgical unit is used. The active electrodes should be equidistant from the proposed cutting line, but situated as away as possible. The conductive parts of Electrodes and associated connectors for applied parts, including the Neutral Electrode, should not contact other conductive parts including earth. Care should be taken to ensure that the diathermy return plate is clean and makes good contact with patient. Though spikes may be observed in the ECG trace when diathermy is used on the patient, but there is instantaneous recovery of the ECG trace when diathermy electrodes are removed from the patient.
- Always ensure ECG cables are properly placed to avoid which may cause interference signals resembling cardiac waveforms, from other equipment.
- Poor ECG trace can occur due to dry electrodes. To rectify, remove the electrodes, apply gel and reattach with new tape. (Replace incase of disposable electrodes). This monitor meets the safety requirements for direct cardiac monitoring.

Steps for application of ECG electrodes :

Proper skin preparation is necessary for good quality signal pick up and display. Please follow the guidelines as listed below:

1. Wash electrode site and shave surface hair.
2. Gently rub skin surface with a prep pad to remove outer epidermal layer.
3. Thoroughly clean site with soap and water, depending on your patient's skin type and sensitivity.
4. Allow site to dry thoroughly.
5. Check the expiry date on the electrode package. Ensure that the electrode gel is fresh before placing the electrode on the patient.
6. Use one electrode brand for all electrodes placed on a single patient. Mixing electrode brands may cause a fuzzy base f line or a lead fault message.
7. Place an electrode on a flat, nonmuscular area to avoid motion artifact.
8. Procedure for applying the electrodes may vary with the type of electrode:
   - Wet gel type-press down along the edge of the electrode so that all edges adhere firmly to the skin. Do not press central contact area of electrode.
   - Solid gel type-begin by pressing on the gelled area, then apply pressure toward outside of electrode.
9. Replace the electrodes at least every 48 hours.
10. Reusable ECG electrodes can be applied after applying a little bit of ECG gel on the cup of the electrodes and then securing the electrode at site using sticking tape or suitable adhesive tape.
11. Fasten the electrode leads with surgical tape (with an extra length of wire between the tape and the electrode).

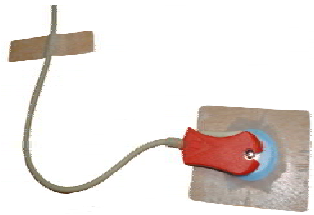


Figure 2.7

12. In operation theatres, please ensure that the disinfecting/cleaning solutions do not come in contact with ECG electrodes.

Clinical Limitations :

- Shivering patients or patients giving exceptionally low signals can be difficult to monitor.
- Although the monitor is provided with exceptionally good filters against the effects of electrosurgery, this technique can affect readings.
- Defibrillation causes temporary disruption of the waveform display.
- Patients with burns may need special needle electrodes.

Planet 55 has 3 lead / 5 lead ECG options for monitoring ECG. L&T offers either of these cables:

- 3 lead ECG cable (I, II, III) .
- 5 lead ECG cable (I, II, III, aVr, aVl, aVf, V).

Respiration

(When sourced from ECG cable)

Tests of respiratory functions are carried out for various reasons, including the assessment of lung disease, monitoring the condition of patients under anesthesia or under intensive care and the investigation of normal lung physiology.

The body, in particular the brain requires a constant supply of blood with dissolved oxygen and carbon dioxide of around 100 and 40 mmHg respectively. For maximum efficiency, perfect matching of air and blood flow is required in each of the lungs alveolar compartments, with overall ventilation rate of 18-20 breaths per minute.

There are several ways to measure respiration. In *Planet 55*, respiration can be measured either through Capnography or ECG. Priority is given to Capnography. If Capnography option is not provided then respiration is measured from ECG. When measured from ECG, respiration measurement is based on impedance pneumography. This method comprises of passing a low current, high frequency carrier signal between two ECG electrodes on either side of the chest wall. The impedance or resistance of the chest changes as the lungs expand and contract and as the volume of air in the lung changes. The change in impedance creates a change in voltage across the carrier signal which is interpreted as a breath and displayed as an analog waveform. Respiration Rate is displayed as a digital value.

The ECG electrodes are to be placed as shown in the diagram below. However, in order to improve the respiration measurement, it may be found useful to move the Right Arm electrode (R) within the area shown in the diagram.

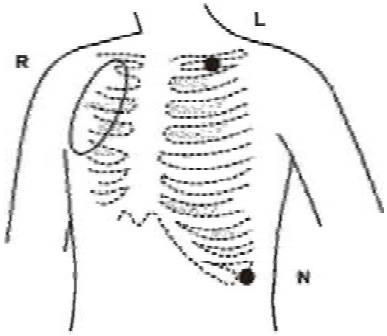


Figure 2.8

Respiration can be monitored through same ECG cables (3/5 lead) or through Capnography. Priority for respiration is given to Capnography, if the option is installed.

Temperature

Temperature is one of the important parameters of multiparameter monitor. L&T offers dual temperature monitoring facility in ***Planet 55***. It is a useful diagnostic tool and specially true when differential temperatures needs to be monitored.
Ex:

- Body temperature of premature baby and temperature of the incubator.
- Core temperature (Oral and Oesophageal) and temperature of periphery (Skin).
- Temperature difference between oral and rectal reading (for e.g., if suspected appendicitis)

Although temperature is an easy parameter to monitor, for realistic interpretation of data, it is important to bear in mind the influence of such factors as:

- Part of body, where temperature is monitored. (Extremities are always at lower temperature than core temperature.)
- Body temperature change throughout the day.
- Menstrual cycle. A rise of about 0.3 ^{0}C takes place during ovulation.

The three zones most commonly used for measuring temperature are:

1. Rectal (typically 37 ^{0}C)
2. Oral (typically 37 ^{0}C)
3. Axillary (underarm) (typically 36 ^{0}C)

Preference is given to rectal measurement since, it is the most accurate, being least subject to patient movement. Axillary is least favored.

L&T ***Planet 55*** is compatible with YSI 400 series of temperature probes.

YSI 401	:	Rectal/Oesophageal temperature probe (Adult).
YSI 402	:	Rectal/Oesophageal temperature probe (Neonatal).
YSI 409A	:	Tape-on skin probe.

Note

Apply gauze piece and sticking plaster to cover temperature sensor of YSI 409A (tape-on skin) for better results.

Pulse Oximetry

Principles Of Operation

The *Planet 55* monitor helps in monitoring continuous, non-invasive, automatically calibrated measurements for both functional oxygen saturation of haemoglobin and pulse rate.

The instrument combines the principles of spectrophotometric oximetry and plethysmography. It consists of an electro-optical sensor that is applied to the patient and a microprocessor based monitor that processes and displays the measurements. The electro-optical sensor consist of two low-voltage, low intensity light-emitting diodes (LEDs), one red and one infrared, that serves as light sources and one photodiode as a detector.

With each heart beat, a pulse of oxygenated arterial blood flows to the sensor site. This oxygenated haemoglobin differs from deoxygenated haemoglobin in the amount of red and infrared light that it absorbs. The *Planet 55* measures absorption of both red and infrared light and uses those measurements to determine the percentage of functional haemoglobin that is saturated with oxygen.

Initially, light absorption is determined when the pulsatile blood is not present. This measurement indicates the amount of light absorbed by tissue and nonpulsatile blood absorption that does not change substantially during the pulse. This is analogous to the reference measurement of a spectrophotometer. Absorption is then measured when the pulsatile blood is present. In that measurement, light absorption at both wavelengths is changed by the presence of the pulsatile, arterial blood. The *Planet 55* then corrects the measurement obtained during the pulsatile flow for the amount of light that was absorbed at the initial measurement. The ratio of the correct absorption at each wavelength is then used to determine functional oxygen saturation.

SpO_2 Sensors

WARNING

Use only L&T approved sensors. Use of sensors produced by other manufacturers may result in improper oximeter performance.

Incorrect application or use of a sensor may cause tissue damage or improper operation of *Planet 55*. Carefully read the “WARNING” section of this manual and the directions for use provided with the sensor.

Selecting a sensor

Each sensor is designed for application to a specific site(s) on patients within a designated weight range. To select the appropriate sensor, consider the patient's weight and which sensor application sites are available, as well as the level of patient activity, whether sterility is required, the anticipated duration of monitoring, and the adequacy of the patient's perfusion.

- Dura sensor DS100 (Adult).
  Dura-Y (Infant to adult).
  Dura-Y (Neonate).
  Extension cable.
- Prepare the application site, remove nail-polish, clean surface area of contact incase of neonates and apply the oxygen transducer using the sensor application guide of pulse oximetry transducer.
- The perfusion indicator fills up the bar and plethysmographic waveform will be displayed accompanied by an audible beep and numerical values of SpO_2 and PR* (pulse rate) are displayed on the screen. (*Incase ECG is not connected.)
- SpO_2 sensor comprises of two parts :
  (a) Patient end (Main Sensor).
  (b) Monitor end (Extension Cable).

Accessories for Pulse Oximeter

- DS 100™ (Dura Sensor) for adults application (patients above 40 Kg).
- Dura Y™ for universal application (patients above 1 Kg to 80 Kg).
- Extension cable.

WARNING

SpO_2 sensor may not get recognized, if the sensor is plugged and unplugged rapidly when the monitor is 'ON'.

Note

Do not connect the SpO_2 sensor and NIBP cuffs to the same limb of the patients.

Preparation for NIBP monitoring :

1. Place the patient in supine position and connect the BP cuff to the arm.
2. If the cuff is not placed at level of the heart then the pressure values obtained will not reflect the true physiological pressure.

Note

Accuracy of NIBP performance / results depends on patients pre clinical condition and the technique used (oscillometric method of calculating NIBP).

Precautions with automatically cycled bp measurements :

1. Place the limb in such a way to minimize stretching and avoid weight exertion on affected nerves.
2. Select a measurement interval that provides adequate venous drainage during cuff deflation.
3. The limb on which the cuff is connected must be inspected periodically in order to detect venostasis.

Note

Do not measure NIBP continuously, as it might result in prolonged impairment of the blood circulation of the patient.

4. An accurate BP determination might be difficult if the patient has irregular cardiac rhythm.
5. Cuff size selection is a very important criteria to get accurate blood pressure readings.
6. Avoid compression or restriction of NIBP pressure tube.

Note

Cuffs become soft after use. They sometimes develop folds which are permanent and hence leave temporary marks on the limb. Any cuffs that exhibit this effect should be replaced.

If NIBP is used with SpO_2, (PR) pulse rate is derived from Plethysmograph.

If NIBP, SpO_2 and ECG all three are connected to patient; then (HR) heart rate is derived from ECG.

Caution

Extreme caution must be taken when NIBP is set to STAT mode on all types of patients. Reports have been made of nerve injury occurring during use of automatically cycled blood pressure measurements.

Caution

For NIBP measurements :

- The cuff selected must fit the upper limb properly and must overlap to encircle the limb on which it is applied. There should not be any air gap in between the cuff and the limb. It can be fastened using the Velcro strap.
- The usual application sites of the cuff is the brachial artery. The right size of cuff should be wrapped around the arm to achieve the best result.
- The cuff is designed to inflate only when it is wrapped on the limbs. Do not inflate the cuff when not supported by the extremity.

WARNING

The cuff should not be applied on a limb being used for an intravenous infusion.

NIBP basic configuration comprises of following accessories:

• Adult cuff	(14 cm x 37 cm)	(Reusable)
• Child cuff	(9 cm x 27 cm)	(Reusable)
• Neonate cuff	(3 cm x 9 cm)	(Disposable)
• Hose tube	(3 meters)	(Reusable)

Theory of operation

The principle of Capnography is based on the absorption of infrared radiation by CO_2. The technique is known as non-dispersive infrared absorption technique. The spectral region is particularly appropriate for measuring carbon dioxide because it has a strong absorption band in the near Infrared wavelength. CO_2 selectively absorbs specific wavelengths of Infrared light. The main part of the system is CO_2 bench, which consist of one IR source and detector. A sample of patient's expired gas that consists of CO_2, Water vapors, Nitrogen, Anaesthetic Agents, etc. is drawn from a lightweight T-piece through a sample line into the CO_2 bench. Expired air is aspirated into measuring chamber (CO_2 bench) by a small pump. The amount of light passing through a sample cell varies according to the concentration of CO_2 in the sample cell. When concentration of CO_2 in sample cell is high, more light is absorbed by the sample and therefore a small amount of light reaches the detector as compared to low concentration of CO_2. The amount of light absorbed is proportional to the concentration of CO_2. The CO_2 concentration measured by the monitor is usually expressed as end tidal concentration of CO_2 ($EtCO_2$), expressed in terms of mmHg or percentage (%) or Kilopascal (Kpa).

Capnogram - Nature of waveform

CO_2 waveform reflects various stages in breathing. Capnograph is an important diagnostic tool because its shape is virtually identical in all basically healthy people.

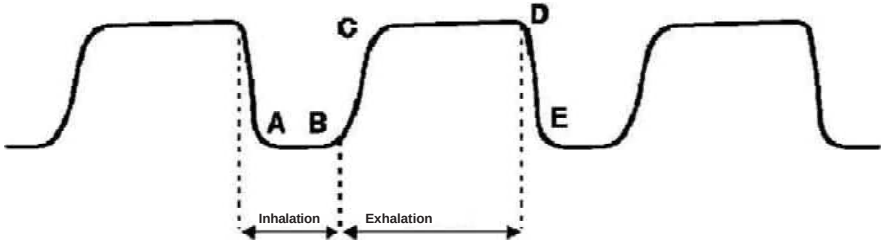


Figure 2.9

End tidal CO_2 is the concentration of CO_2 measured at the end of tidal volume expired (Point D in above diagram).

A - B : The base line, that is the level of minimum CO_2 concentration, observed immediately after inspiration.

B - C : The expiration phase of respiration cycle.

C - D : The expiratory plateau, that is the period during which the level of CO_2 in the lungs ceases to increase significantly.

D : The end-tidal concentration point, that is the point at the end of the expiration phase, at which $EtCO_2$ is measured.

D - E : The onset of the inspiration phase of the respiration cycle.

The production, transportation and elimination of CO_2

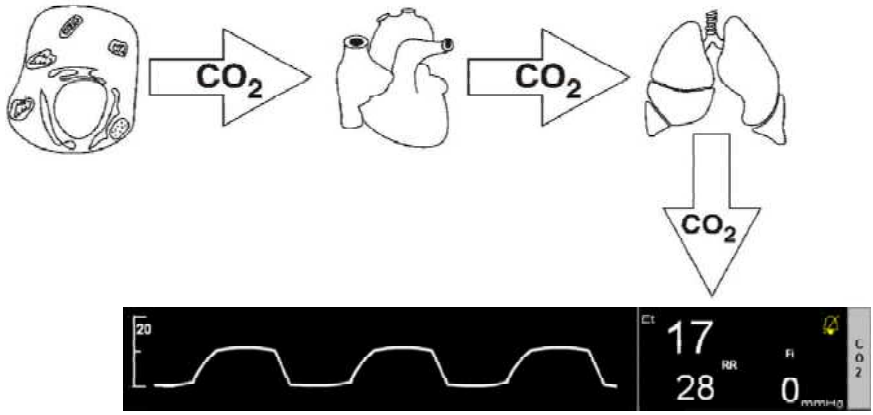


Figure 2.10

CO_2 is produced by all the cells in all the tissues in body as a by-product of metabolism. From the cell, CO_2 diffuses into capillary blood, from where CO_2 is transported into venous circulation. During contraction of heart, venous blood is pumped through pulmonary circulation to the lungs for gas exchange. Lungs are made up of millions of alveoli, which permits easy gas diffusion from pulmonary blood to alveolar gas space. CO_2 diffuses into this space because continuous breathing keeps CO_2 concentration in alveoli lower than that in pulmonary circulation. During exhalation, gas leaving lungs mixes thoroughly, so Capnograph measures average concentration of CO_2 from all the alveoli. Capnography gives an excellent pictures of respiratory process.

Arterial to alveolar difference of CO_2

Although end tidal CO_2 closely follows blood CO_2 level, they are not exactly same, Normally, the arterial blood CO_2 level ($PaCO_2$) is higher by 3-4 mmHg than the alveolar CO_2 ($PaCO_2$). The $AADCO_2$ is due to a mismatch of ventilation and perfusion of the alveoli in the lungs. (Even in healthy patient, there are some part of lungs which are not perfused as well as they are ventilated). In such case when patient exhales, CO_2 gas from the unperfused part of the lungs will dilute the CO_2 rich alveolar gas coming from rest of the lungs, lowering the $EtCO_2$, hence $AADCO_2$ increases. This is known as alveolar dead space ventilation.

Arterial Blood CO_2	:	$PaCO_2$
Alveolar CO_2	:	$PaCO_2$

Arterial to alveolar difference $AADCO_2$ which is normally 3-4 mmHg.

Technology Used

Capnography measurement is done with the help of microstream technology in this unit.

Microstream Capnography

In microstream capnography method, the optical sensor is incorporated in the module. Gas sample is aspirated from the patient at a flow rate of 50 ml/min with the help of Filter Line (connected to endotracheal tube with the help of 'T' connector or directly from nose with the help of Nasal prongs) and is given to module. The CO_2 measurement takes place at the CO_2 bench. After the measurement, the waste gas exhausted from the rear panel.

Respiration Rate

The respiration rate is defined as the average rate of the patient's last 8 significant measured breaths. During the first 8 breaths the respiration rate is calculated by averaging the available data. The module measures the RR in range of 0 to 150 bpm.

Initialization Time

The module requires a typical time of 30 seconds before entering into the first operating mode. During this time, the module completes self test and initialization procedures required for proper operation of the module.

"Auto Zero" Interval

The Auto zero process is performed only during measurement mode. The module updates the ambient pressure that is measured during auto zero process. The auto zero is triggered.

- During the first hour after entering measurement mode, periodically for durations of typically 15 seconds at a rate which limits the total time consumed by auto zeros to less than 2 % of the time in which active measurements are taken. Following the first hour after entering measurement mode, periodically for durations of typically 15 seconds at a rate of at most once per hour.
- If a change of 8 ^{0}C from the last auto zero is detected.
- If a pressure change of 20 mmHg relative to the last auto zero (less than the purge threshold) for a period of 30 seconds is detected. The module will be able to detect a real change in the ambient pressure and a pressure change due to partial blockage of the Filter Line.

  The module prevents the triggering of an auto zero in the following situations:
- Incase of purging until the end of this state.
- 20 seconds to 3 minutes from the last detected breath.
- While wait up to 5 minutes for host auto zero enable command.

Leak Tightness

The leak rate of the module flow system is less than 40 mBr/min when a 30% vacuum is invoked on the flow system.

Filter Line Recognition Safeguard (FRS)

The "FRS" enables the module to detect the presence of the Filter Line at start-up and in normal operation. The pump does not draw in gas from the input port when a Filter Line is not connected. While in normal operating mode the "FRS Lock" detection time is no longer than 1 second.

Purge

The module performs a purging whenever it detects an occlusion in the Filter Line or in the airway adapter. The module informs the host of the purge situation by setting the "Purging in progress" bit in the Wave Message While purging, the CO_2 values are invalid. The duration of the purging is up to 30 seconds. If the occlusion is not removed, the module sets the fault bit in the wave message and sets the "Occlusion in gas input lime" WARNING code. The module recovers from occlusion when Filter Line is replaced. The module then shifts to initialization mode for typically less than 5 seconds and then goes to normal measurement mode.

Definitions

Breath	:	A rise and fall in the carbon dioxide concentration of at least one percent carbon dioxide is no less than 0.4 seconds. One inhalation + One exhalation = One Breath.
Respiration Rate (RR)	:	Number of Breaths per Min.
End Tidal Carbon dioxide ($EtCO_2$)	:	The level of CO_2 in the airway at the end of expiration. In L&T's Capnography one breath is the sampling interval, therefore monitor will report the CO_2 level at the end-respiration point of each breath.
Fractional Inspired Carbon dioxide ($FiCO_2$)	:	The amount of CO_2 inspired during inspiration i.e. re-breathing of CO_2.

Machine Preparation

1. Switch ON the unit.
2. Make sure the patient connection to the unit with the help of Filter Line and T Connector.
3. Machine takes approx. 30 seconds for its initialization. During this time sensor gets warmed up and 'initializing module' message will appear on the screen.
4. Then monitor will perform Auto Zero (if required) and 'Auto Zero' message will appear on the screen.
5. Monitor is ready for Capnography monitoring.

Patient Preparation

1. Prepare the patient for CO_2 measurement. Use recommended accessories.
2. Screw up one end of the 'T' Connector to the unit through Filter Line. Use proper types for adults and neonatal accessories.

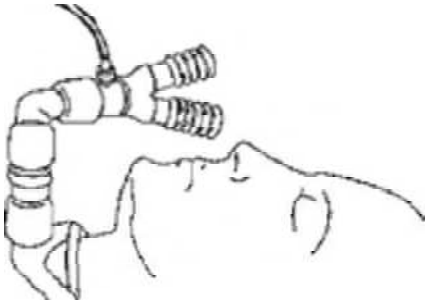


Figure 2.11

Patient with 'T' connector connected to Endotracheal tube.

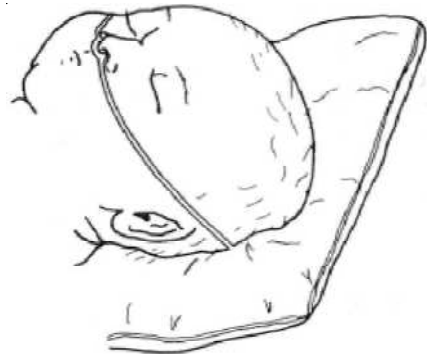


Figure 2.12

Patient with Nasal Prong (Adult and Pediatric nasal prongs are available).

Caution

- Do not strain the Filter Line during the measurement. Connection should be done in such-a-way that Filter Line will not surround any part of the body.
- Ensure that the Filter Line does not have blockage or occlude with moisture before use.

Following accessories are provided for Capnography along with *Planet 55* monitor.

- Capno Line
  - Adult
  - Paediatric
  - Infant - Neonate
- Filter Line
  - Adult / Paediatric
  - H set Adult / Paediatric
  - H set Infant / Neonatal

3

OPERATIONS AND MAIN SCREEN

Notes:

Operation

Connect the unit to a mains supply socket with a proper ground / earthing connection.

Power ON	Press monitor ON/OFF switch () on the front panel so that green indicator turns ON and the unit runs the self-test and displays main (home) screen. Use the Optical Encoder on right side to move the cursor (highlighted small rectangular block) and select the desired functions, by pressing optical encoder.

Main Screen 1

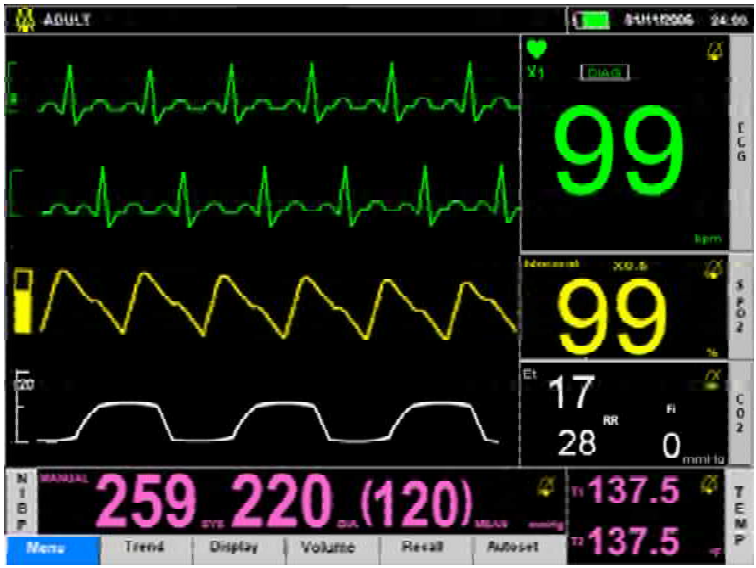


Figure 3.1

Note

Main screen with a SpO_2, CO_2 and two ECG waveforms.

Main Screen 2

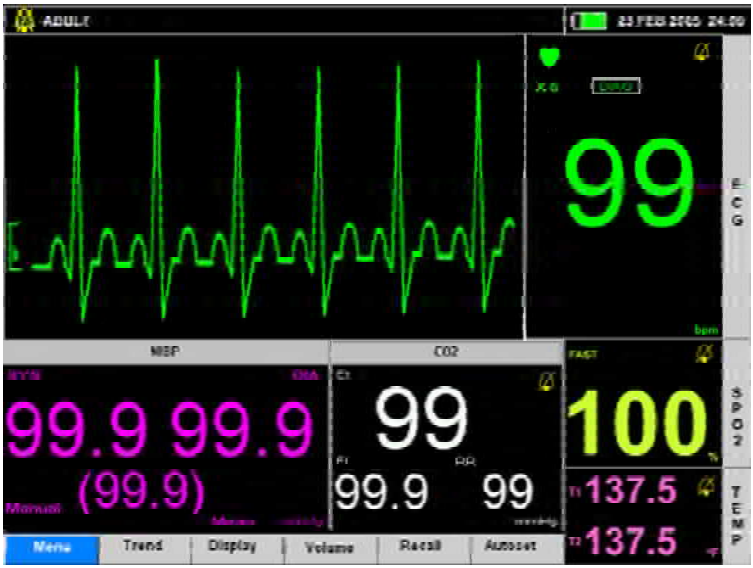


Figure 3.2

Note

Main screen with a single ECG waveform and 4 digital values when CO2 present.

Main Screen 3

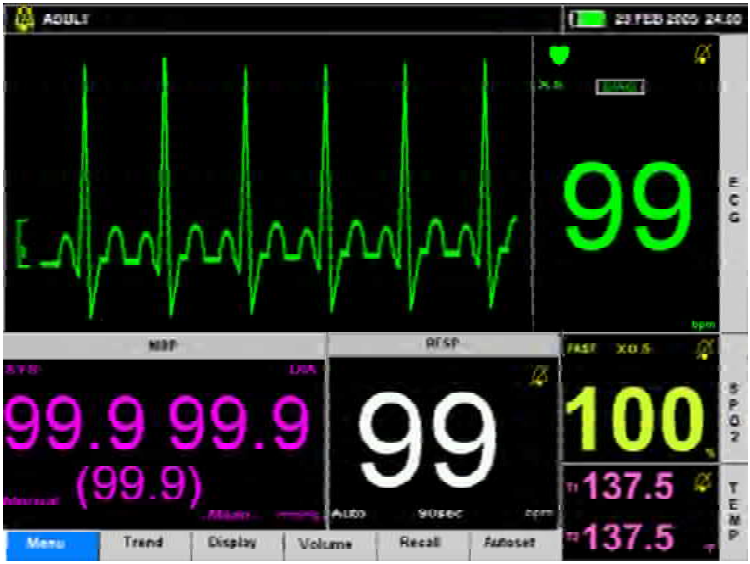
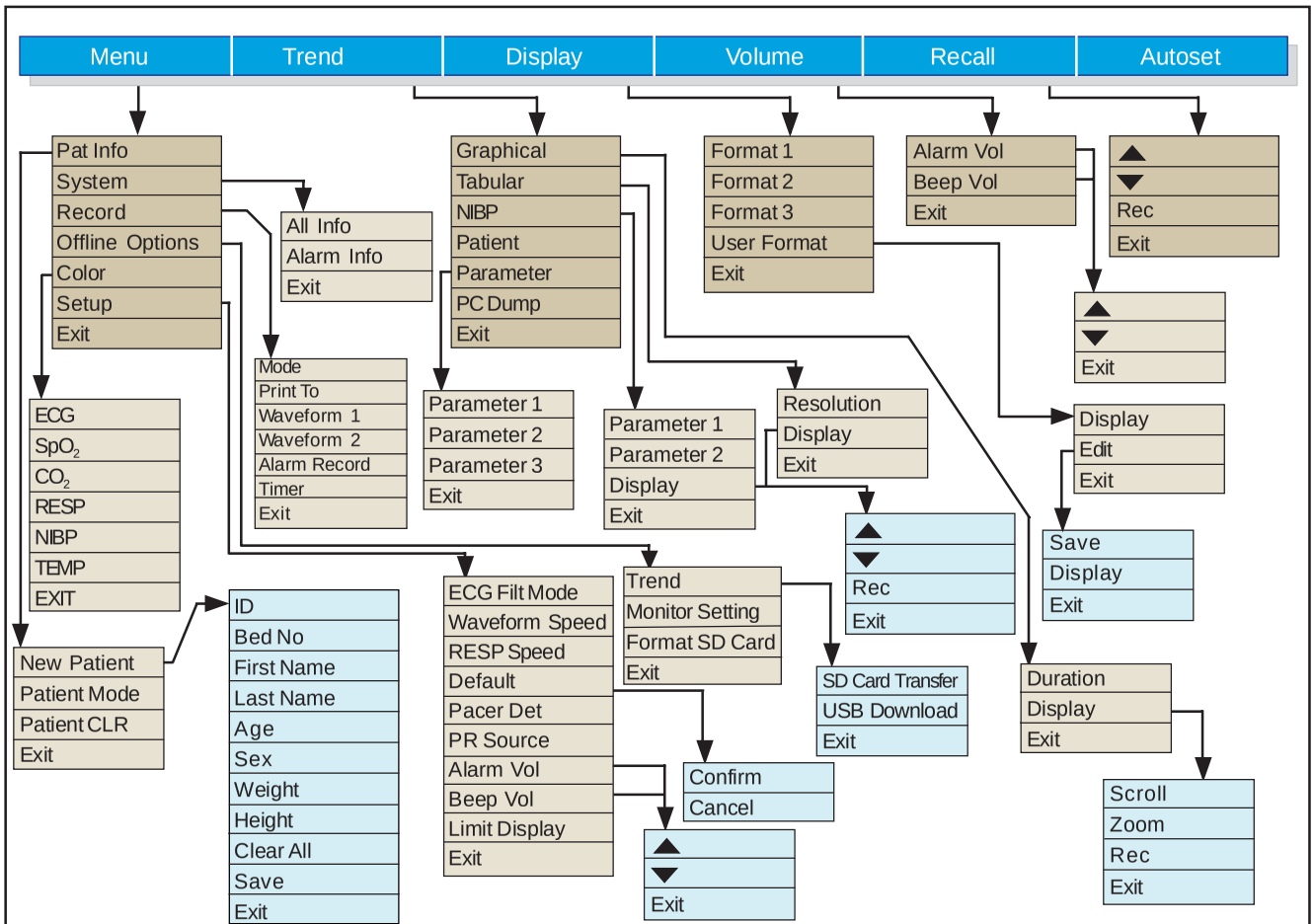


Figure 3.3

Note

Main screen with a single ECG waveform and 4 digital values when RESP present.


Menu
Trend
Display
Volume
Recall
Autoset
Pat Info
System
Record
Offline Options
Color
Setup
Exit
All Info
Alarm Info
Exit
Mode
Print To
Waveform 1
Waveform 2
Alarm Record
Timer
Exit
ECG
SpO2
CO2
RESP
NIBP
TEMP
EXIT
New Patient
Patient Mode
Patient CLR
Exit
ID
Bed No
First Name
Last Name
Age
Sex
Weight
Height
Clear All
Save
Exit
Graphical
Tabular
NIBP
Patient
Parameter
PC Dump
Exit
Parameter 1
Parameter 2
Parameter 3
Exit
ECG Filt Mode
Waveform Speed
RESP Speed
Default
Pacer Det
PR Source
Alarm Vol
Beep Vol
Limit Display
Exit
Confirm
Cancel
Exit
Format 1
Format 2
Format 3
User Format
Exit
Parameter 1
Parameter 2
Display
Exit
Resolution
Display
Exit
Trend
Monitor Setting
Format SD Card
Exit
Rec
Exit
SD Card Transfer
USB Download
Exit
Alarm Vol
Beep Vol
Exit
Exit
Rec
Exit
Display
Edit
Exit
Save
Display
Exit
Duration
Display
Exit
Scroll
Zoom
Rec
Exit

Menu	Select this to go to Monitor Settings / System Functions.
Trend	Select this to retrieve the data of the patients recorded.
Display	Select this to choose the Display Formats.
Volume	Select this to adjust the Alarm Volume and Beep Volume.
Recall	Select this to Recall last 24 patient related alarm conditions in tabular format.
Autoset	Select this to set alarm limits automatically for all parameters except NIBP.

ECG :

HR/PR high limit = Present HR value X 8/10 + 76

HR/PR low limit = Present HR value X 8/10 + 2

SpO_2 :

SpO_2 high limit = 100

SpO_2 low limit = (Present SpO_2 value – 8) or 80 (Whichever is greater)

Respiration :

Respiration high limit = Present RR + 5

Respiration low limit = Present RR – 5

Temperature :

Temperature high limit = Present Temp value + 2

Temperature low limit = Present Temp value – 2

Capnography :

$EtCO_2$ high limit = Present value + 5

$EtCO_2$ low limit = Present value – 5

$FiCO_2$ high limit = Present value + 2

$FiCO_2$ low limit = 0

WARNING

Check if the current alarm preset value is appropriate, prior to use on each patient.

ECG	Select this to enter into ECG menu.
RESP	Select this to enter into Respiration menu.
SpO_2	Select this to enter into SpO_2 menu.
NIBP	Select this to enter into NIBP menu.
CO_2	Select this to enter into Capnography menu.
TEMP	Select this to enter into Temperature menu.

Monitor Setup Menu Is Displayed If Optical Encoder Is Pressed During Self Test (Start-up Sequence)

Setting	Date	Time	Commn.	Demo	Exit

Setting : Select this to choose the default settings in the unit like selecting Date Format, measurement unit for the parameters etc.

Date Format : Select this to choose the Date Format from the list. The different Date formats in the list are as given below.

- DD\MM\YYYY
- DD MMM YYYY
- MM\DD\YYYY

HR Alarm Con ON : Select ON to continuous ON HR alarm.

SpO_2 For NIBP : Select this to enable / disable SpO_2 monitoring during NIBP measurement

Language : Select this to choose the Languages from the list. The different languages in the list are as given below.

- English
- French
- Spanish
- Italian
- Bhahasa*
- Russian*
- German
- Chinese*
- Turkish

* Future upgrade

NIBP Test : This should be used by L&T authorized service engineer only.

CO_2 Cal : This should be used by L&T authorized service engineer only.

ECG/TEMP Cal : This should be used by L&T authorized service engineer only.

Alarm Type : Select this to choose either Latched or Non Latched as Alarm Type.

Unit : Select this to choose the measurement unit for the parameter from the list. The different parameters and the units in the list are as given below.

Parameters	Unit
NIBP	mmHg and kPa
CO_2	mmHg, kPa and Vol%
Temp	Centigrade and Fahrenheit
Height	inch and cm
Weight	kg and lb

Default Setting : Select this to choose either Hospital or Factory settings as

Note

Press Alarm Ack and Home keys simultaneously in Monitor Setup menu to store the current settings as Hospital setting.

The Factory Default Settings are as follows:

Factory Default Settings:

ECG:

Alarm	:	Disable
Gain	:	1mV
Lead	:	II
Trace Speed	:	25 mm/sec
HR Upper Limit	:	150 (A) 160(P) 180(N)
HR Lower Limit	:	50(A) 60(P) 80(N)
Pacer	:	OFF

SpO_2:

Alarm	:	Disable
Gain	:	X1
Response	:	Normal
Trace Speed	:	25 mm/sec
HR Upper Limit	:	100(A) 100(P) 100(N)
HR Lower Limit	:	85(A) 85(P) 85(N)

CO_2:

Alarm	:	Disable
Scale	:	40
Unit	:	mmHg
Trace Speed	:	12.5 mm/sec
$EtCO_2$ Upper Limit	:	40(A) 40(P) 40(P)
$EtCO_2$ Lower Limit	:	25(A) 25(P) 25(N)
$FiCO_2$ Upper Limit	:	4(A) 4(P) 4(N)
RR Upper Limit	:	30(A) 100(P) 100(N)
RR Upper Limit	:	10(A) 10(P) 50(N)
No Breath	:	30 sec(A) 30 sec(N) (If enabled)

NIBP:

Alarm	:	Disable
Mode	:	Manual
Auto Timer	:	2 min
SYS Upper Limit	:	150(A) 135(P) 120(N)
SYS Lower Limit	:	95(A) 95(P) 50(N)
DIA Upper Limit	:	100(A) 100(P) 80(N)
DIA Lower Limit	:	65(A) 65(P) 20(N)
Unit	:	mmHg

Temp:

Alarm	:	Disable
Unit	:	°F
Upper Limit	:	104.0(A) 104.0(N)
Lower Limit	:	89.6(A) 89.6(N)

Resp:

Alarm	:	Disable
Gain	:	X4
No Breath	:	Disable
No Breath Timer	:	30 sec
RR Upper Limit	:	30(A) 100(P) 100(N)
RR Lower Limit	:	10(A) 10(P) 50(N)
Resp Speed	:	12.5 mm/sec

General:

Trend parameters shall be HR, SpO_2 and Resp.
Recorder mode shall be Delayed.
Recorder waveform shall be None.
Alarm volume shall be 6th step.
Beep volume shall be 6th step.
ECG filter mode shall be Mon.
CO_2 pump shall be ON.
Rec ON Ala shall be OFF.
Tabular Trend resolution shall be 30 sec.
Graphical trend scale shall be 2 Hrs.
Resp Scurce shall be RA-LA for respiration.
Resp Source shall be CO_2 for CO_2 module.
Display shall be in Format1 for 3/5 lead ECG cable.

Non Disp Para Alm: Select this to choose either Audio/LED ON or Audio/LED OFF alarm for Non displayed parameter.

Monitor id : Select this to set monitor id.

Exit : Select this to quit from Setting option.

Date : Select this to set Year, Month and Date.

Time : Select this to set Hour and Minute.

Commn. : Select this to configure Ethernet and Serial ports.

Ethernet* : Select this to set MAC ID, IP Config, Subnet Mask and Default Gateway by drop down list.

Serial : Select this to choose serial port (RS 232) for PC Dump and Nurse Call* output.

Demo : This should be used by L&T authorised service engineer only.

Exit : Select this to quit from Configuration Mode.

* Future upgrade

4

PARAMETER SETTING

Notes:

ECG

When ECG option is selected in the Main screen, ECG Setup window will pop-up on the screen as shown below.

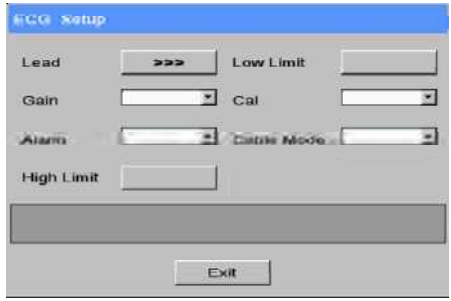


Figure 4.1

Lead : When Lead is selected, depending upon the Cable mode chosen 3/5 Lead setup window will appear as shown below. Select max. one lead with its cascade waveform in 3 Lead setup and select max. four leads in 5 Lead setup.

Figure 4.2

Figure 4.3

OK : Select this to save the settings and exit from Lead setup.

Exit : Select this to exit from the Lead setup without saving the settings.

Gain : Select this to change the height of the ECG waveform in scales X0.2, X0.5, X0.75, X1, X2, X5 and Auto.
X0.2 will provide the lowest amplitude and X5 will have maximum amplitude.

Note

Select ECG gain so that entire ECG waveform should appear without clipping at top or bottom as seen on the display or on print-out.

Alarm : Select this to enable / disable HR alarm detection from the drop down list.

High Limit : Select this to set upper alarm limits for HR from Numeric keypad as shown below (To use this function, ensure that alarm is enabled).

Figure 4.4

Low limit : Select this to set lower alarm limits for HR from the Numeric keypad (To use this function, ensure that alarm is enabled).

Cal : Select this to enable (switch ON) or disable (switch OFF) Cal option. When it is selected, Cal pulse of 1mV amplitude will be displayed on the screen.

Note

Cal is possible only for Lead II, Lead III and Lead V.

Cable Mode : Select this to choose 3 / 5 Lead ECG cable.

Note

♥ Flashing heart in parameter display area indicates valid QRS / Pulse detection. ECG speed (6.25/12.5/25/50 mm/sec) and ECG Mode (Mon / Diag / OT) options are provided in Setup menu and displays value after window averagingf of last 8 QRS peaks.

Exit : Select this to save the settings and return to main screen.

RESP (When sourced from ECG cable)

When RESP is selected in the Main screen, Resp setup window will pop-up on the screen as shown below.

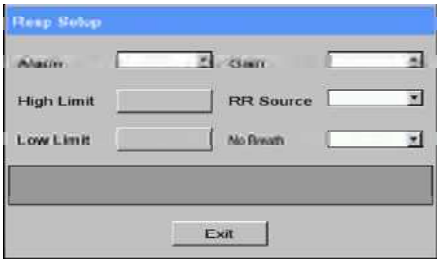


Figure 4.5

Alarm : Select this to enable / disable Respiration alarm detection from the drop down list.

High Limit : Select this to set upper limits for Respiration Rate alarm from Numeric keypad (To use this function, ensure that alarm is enabled).

Low Limit : Select this to set lower alarm limits for Respiration Rate from Numeric keypad (To use this function, ensure that alarm is enabled).

Gain : Select the gain so that waveform does not clip.

Note

The last set gain level is saved in memory. This setting will remain even when the unit is switched OFF.

RR Source : Select this to choose the source for Respiration rate between RA-LA and RA-LL.

No Breath : Select this to choose time limit for nobreath detection.

Exit : Select this to save the settings and return to main screen.

TEMP

When TEMP is selected, Temp setup window will pop-up on the screen as shown below.

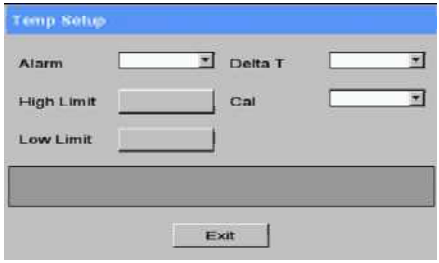


Figure 4.6

Alarm : Select this to enable / disable Temperature alarm detection from the drop down list.

High Limit : Select this to set upper limit for Temperature alarm from Numeric keypad (To use this function, ensure that alarm is enabled).

Low Limit : Select this to set lower limit for Temperature alarm from Numeric keypad (To use this function, ensure that alarm is enabled).

Delta T : Select this to enable or disable Delta T.

Cal : Select this to enable or disable calibration of temperature.

Exit : Select this to save the settings and return to main screen.

SpO_2

When SpO_2 is selected, SpO_2 setup window will pop-up on the screen as shown below.

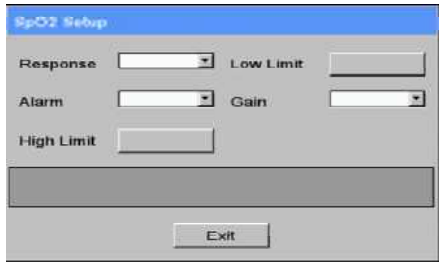


Figure 4.7

Response : Select this to set the response mode for SpO_2 readings from the drop down list.

Normal : Preferred for adults.

Fast : Preferred for sleep studies.

Alarm : Select this to enable / disable SpO_2 alarm by drop down list.

High Limit : Select this to set upper alarm limits of SpO_2 from Numeric keypad (To use this function, ensure that alarm is enabled).

Low Limit : Select this to set lower alarm limits of SpO_2 from Numeric keypad (To use this function, ensure that alarm is enabled).

Gain : Select this to change the amplitude of the SpO_2 waveform in scales of X1 and X0.5.

Exit : Select this to save the settings and return to main screen.

NIBP

When NIBP is selected, NIBP Setup window will pop-up on the screen as shown below.

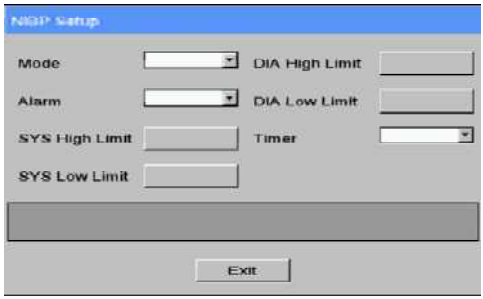


Figure 4.8

Mode : Select this to choose Manual, Stat or Auto mode from drop down list.

Manual : Select this to take individual BP readings. After selecting this function, press start NIBP measurement key on front panel to begin manual NIBP measurement. To abort NIBP measurement midway, press the same key again.

Stat : Select this to take as many readings of NIBP as possible in 5 minutes of continuous operation.

Auto : Select this to take BP readings automatically after set intervals (Timer set). Press Start on the front panel to take the first reading. Next NIBP reading starts after the set time interval. The time left before the next measurement to begin is displayed on screen. This displayed time is decremented every minute. Timer can be set only if Automatic is selected.

Alarm : Select this to enable / disable NIBP alarm detection from the drop down list.

Sys High Limit : Select this to set upper limit for Systolic alarm from Numeric keypad (To use this function, ensure that alarm is enabled).

Sys Low Limit : Select this to set lower limit for Systolic alarm from Numeric keypad (To use this function, ensure that alarm is enabled).

Dia High Limit : Select this to set upper limit for Diastolic alarm from Numeric keypad (To use this function, ensure that alarm is enabled).

Dia Low Limit : Select this to set lower limit for Diastolic alarm from Numeric keypad (To use this function, ensure that alarm is enabled).

Timer : Select this to set timer for Automatic mode. This function allows the user to set the time interval (2, 3, 4, 5, 10, 15, 30, 60 and 90 minutes) between two readings.

Exit : Select this to save the settings and return to main screen.

Note

In NIBP auto mode, time left before the next measurement is displayed at the timer display area. Time displayed is decremented every minute.

CAPNOGRAPHY

When CO_2 is selected CO_2 setup window will pop-up on the screen as shown below.

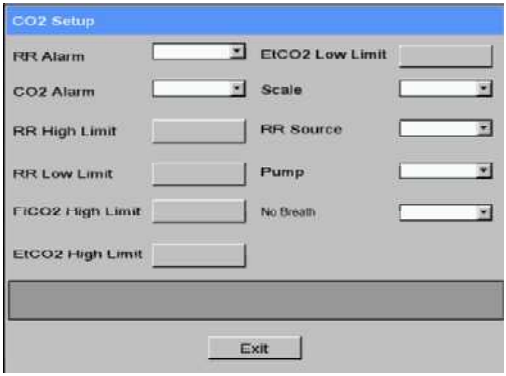


Figure 4.9

RR Alarm : Select this to enable / disable the RR alarm from the drop down list.

CO_2 Alarm : Select this to enable / disable the CO_2 alarm from the drop down list.

RR High Limit : Select this to set upper limit for RR alarm from Numeric keypad (To use this function, ensure that RR alarm is enabled).

RR Low Limit : Select this to set lower limit for RR alarm from Numeric keypad (To use this function, ensure that RR alarm is enabled).

$FiCO_2$ High Limit : Select this to set upper limit for $FiCO_2$ alarm from Numeric keypad. (To use this function, ensure that CO_2 alarm is enabled).

$EtCO_2$ High Limit : Select this to set upper limit for $EtCO_2$ alarm from Numeric keypad. (To use this function, ensure that CO_2 alarm is enabled).

$EtCO_2$ Low Limit : Select this to set lower limit for $EtCO_2$ alarm from Numeric keypad. (To use this function, ensure that CO_2 alarm is enabled).

Scale : Select this to change the amplitude of the CO_2 waveform in scales 20, 40, 60, 80 or 100 mmHg from the drop down list.

RR Source : Select this to choose the source of Respiration Rate either from the CO_2 (if connected) or from ECG (RA-LA or RA-LL).

Pump : Select this to Start / Stop the CO_2 pump.

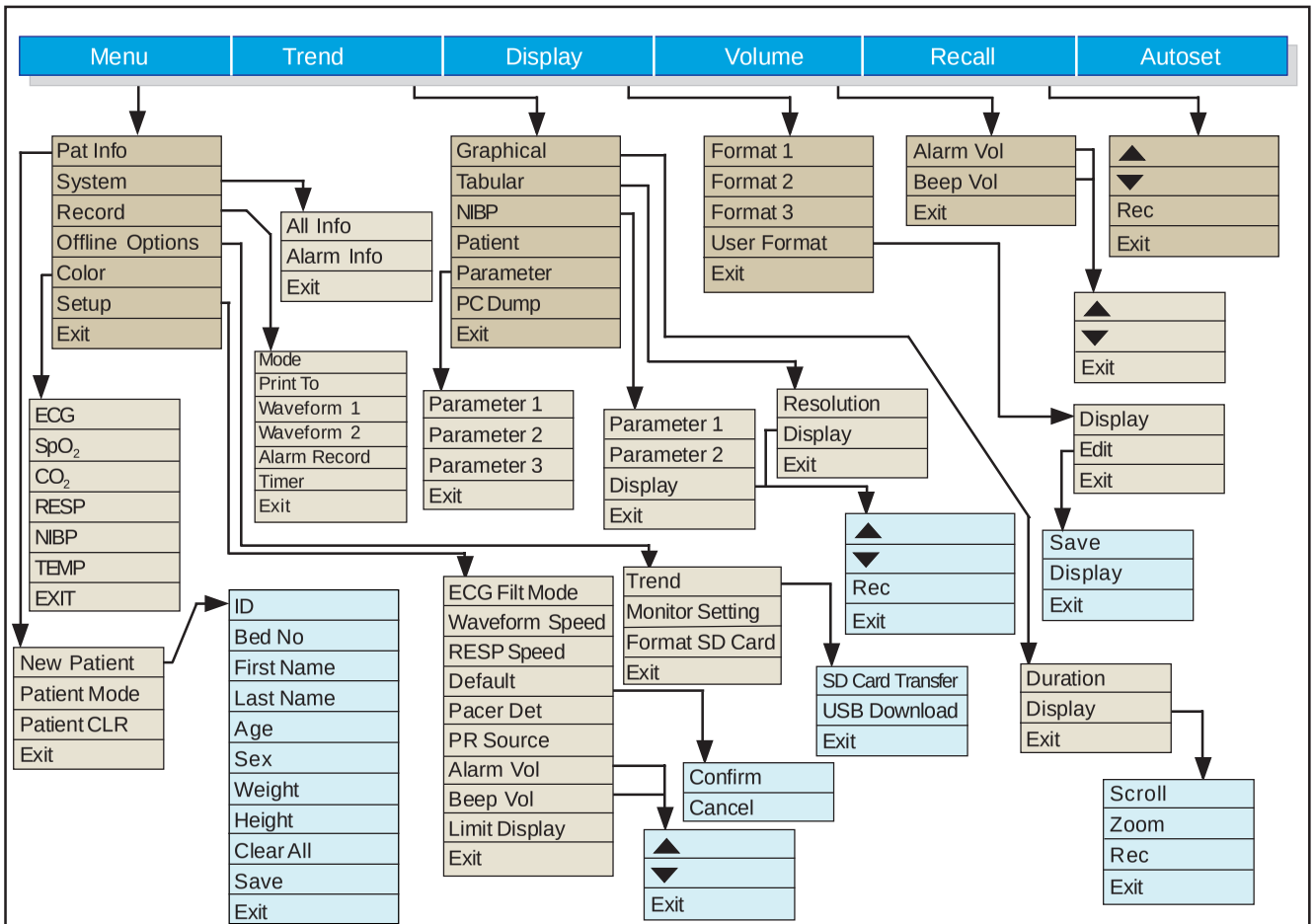
No Breath : Select this to choose time limit for No breath detection.

Exit : Select this to save the settings and return to Main screen.

5

SYSTEM FUNCTIONS

Notes:


Menu
Trend
Display
Volume
Recall
Autoset
Pat Info
System
Record
Offline Options
Color
Setup
Exit
All Info
Alarm Info
Exit
Mode
Print To
Waveform 1
Waveform 2
Alarm Record
Timer
Exit
ECG
SpO2
CO2
RESP
NIBP
TEMP
EXIT
New Patient
Patient Mode
Patient CLR
Exit
ID
Bed No
First Name
Last Name
Age
Sex
Weight
Height
Clear All
Save
Exit
Graphical
Tabular
NIBP
Patient
Parameter
PC Dump
Exit
Parameter 1
Parameter 2
Parameter 3
Exit
ECG Filt Mode
Waveform Speed
RESP Speed
Default
Pacer Det
PR Source
Alarm Vol
Beep Vol
Limit Display
Exit
Trend
Monitor Setting
Format SD Card
Exit
Confirm
Cancel
Exit
Format 1
Format 2
Format 3
User Format
Exit
Parameter 1
Parameter 2
Display
Exit
Resolution
Display
Exit
Rec
Exit
SD Card Transfer
USB Download
Exit
Alarm Vol
Beep Vol
Exit
Rec
Exit
Exit
Display
Edit
Exit
Save
Display
Exit
Duration
Display
Exit
Scroll
Zoom
Rec
Exit

Menu	Trend	Display	Volume	Recall	Autoset

Menu : Select this to go to Monitor Settings / System Functions.

Trend : Select this to retrieve the data of the patient recorded.

Display : Select this to choose the Display Formats.

Volume : Select this to adjust the Alarm Volume and Beep Volume.

Recall : Select this to Recall last 24 patient related alarm conditions in tabular format.

Autoset : Select this to set alarm limits automatically for all parameters except NIBP.

Menu

Pat Info	System	Record	Offline Options	Color	Setup	Exit

Pat Info : Select this to get Patient Info Menu to enter patient details.

Figure 5.1

New Patient : Select New Patient menu, *Planet 55* will display new patient entry panel as shown below.

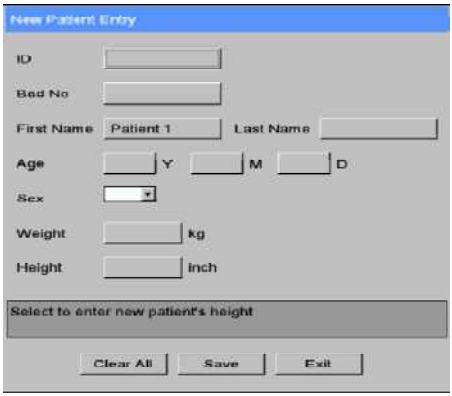


Figure 5.2

ID : Select this to enter patient's identification number from the Alpha-Numeric keypad.

Bed No : Select this to enter patient's bed number from Alpha English keyboard.

First Name : Select this to enter patient's first name from Alpha English keyboard.

Note

The Default name will appears as Patient 1 to Patient 200 in the field First Name, each time it increments by one.

Last Name : Select this to enter patient's last name from Alpha English keyboard.

Age : Select this to enter patient's age from Numeric keypad. The age will be in years for adults and days for neonates.

Sex : Select this to enter patient's sex from drop down list.

Weight : Select this to enter patient's weight from Numeric keypad.

Height : Select this to enter patient's height from Numeric keypad.

Clear All : Select this to reset entered data.

Save : Select this to save the entered data.

Exit : Select this to return to the Patient Info Menu.

Patient Mode : Select this to choose Adult, Neonate or Pediatric mode from drop down list.

Patient CLR : Select this to clear all recorded trend data of selected patient from drop down list. Confirmation window will be displayed.

Exit : Select this to return to the Patient Info Menu.

System : Select this to view all system information and alarm information.

Note

No changes can be made in system Info screen.

All Info : Select this to view the information about the settings of the monitor.

Alarm Info : Select this to view the information about the status of alarm conditions. [Enable / Disable, limits (High and Low)] and the unit of all the parameters.

Exit : Select this to return to the Main Menu.

Record : Select this to set recorder related settings. *Planet 55* will display Recorder menu as shown below.

Figure 5.3

Mode : Select this to choose Direct, Delayed or Continuous recording from drop down list.

Direct : Select this to record real time data for 8 seconds after pressing recorder hot key.

Delayed : Select this to record 8 seconds (previous 6 seconds and real time 2 seconds) after pressing recorder hot key.

Continuous : Select this to record real time data for 30 seconds after pressing recorder hot key.

Print to : Default will be recorder.

Waveform 1
Waveform 2 : Select this to choose the waveforms to be recorded from drop downlist.

Alarm Record : Select this to ON/OFF recording during patient alarm condition.

Timer : Select this to choose the time interval between two consecutive recordings.

Exit : Select this to return to the main Menu.

Offline Options : Select this to transfer the Trend data into removable devices. *Planet 55* will display the Offline Transfer Options Menu as shown below.

Figure 5.4

Trend : Select this to get the window for choosing the device. The window will appear as shown below.

Figure 5.5

SD Card Transfer : Select this to transfer the trend data between similar patient monitors. The following window will appear when SD Card Transfer is selected.

Figure 5.6

Trend Download : Select this to download the trend to the SDCard. When Trend Download is selected, the window will appear as shown.

Figure 5.7

Select All Patients or particular patient to download the maximum of 72 hours of trend data. The trend data consists of Alarm Recall, NIBP Trend and Tabular Trend for all parameters. When patient is selected , the window with the message will appear as shown below.

Figure 5.8

Confirm : Select Confirm to overwrite the data into the SD Card. Wait till the data is transferred into the SD Card. On completion message " Patient data transferred to SD Card" will appear.

Cancel : Select Cancel to exit from the window.

Trend Upload : Select this to upload the trend to the monitor. A Confir mation window with the message as shown below. Select Confirm to proceed further or Cancel to exit from the window.

Figure 5.9

Caution
Ensure that the Monitor is switched OFF before connecting / Disconnecting Thumb drive /SD Card. Don't remove SD card during data transfer.

USB Download : Select this to download the trend data into thumb drive. *Planet 55* has the option to download the trend data of 72 hours (max) of Single patient or All patients at a time. The data consists of Alarm Recall, NIBP Trend and Tabular Trend of all parameters for selected patients. The data will be in csv format and can be opened in Microsoft ® Excel.

Exit : Select this to return to the Offline Transfer Options Menu.

Monitor Setting : Select this to upload and down load the settings of the monitor between two monitors using USB thumb drive.

Format SD Card : Select this to format SD Card. Confirmation message "All data in the SD Card will be deleted" will appear. Select Confirm to proceed further.

Exit : Select this to return to the main Menu.

Color : Select this to choose the color of the parameter from the color box.

Setup : Select this to set the general settings. *Planet 55* will display the Setup menu as shown below.

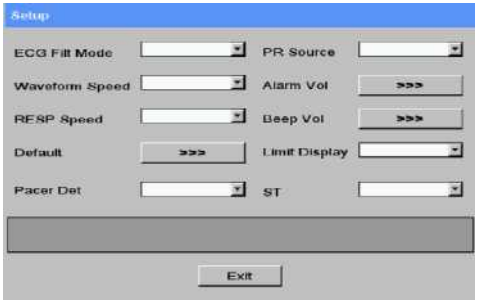


Figure 5.10

ECG Filt Mode : Select this to choose the bandwidths for ECG monitoring from drop down list.
Mon (Monitoring - 0.5 Hz to 120 Hz)
Diag (Diagnostic - 0.05 Hz to 120 Hz)
OT (0.5 - 20 Hz)

Note

ECG waveform amplitude may reduce marginally when filter mode selected is OT due to narrow (20Hz) ECG filter bandwidth. OT mode should not be used for diagnostic application and recommended to be selected only when Electrosurgery interferences are present in ECG waveform.

Waveform Speed: Select this choose the waveform speed for all parameters except CO_2 / RESP from drop down list.

RESP Speed : Select this choose the waveform speed of CO_2 / RESP from drop down list.

Default : Select this to set default (either Hospital or Factory) settings based on the selection in Monitor Setup menu.

Confirm : Select this for the confirmation to set the default settings.

Cancel : Select this for the cancellation of default settings.

Pacer Det : Select this to choose pacer detection ON/OFF from drop down list.

PR Source : Select this to choose PR Source either NIBP or SpO_2 from drop down list.

Alarm Vol : Select this to adjust alarm volume. *Planet 55* will display volume menu.

▲ : Select this to increase the alarm volume.

▼ : Select this to decrease the alarm volume.

Exit : Select this to return to the Setup panel.

Beep Vol : Select this to adjust beep volume. *Planet 55* will display volume menu.

▲ : Select this to increase the beep volume.

▼ : Select this to decrease the beep volume.

Exit : Select this to return to the Set up panel.

Limit Display : Select this to enable / disable the Display limits.

ST : Select this to enable / disable the ST option.

Exit : Select this to return to the Main menu.

Exit : Select this to return to the Main screen.

Trend

Graphical	Tabular	NIBP	Patient	Parameter	PC Dump	Exit

Planet 55 will display the Trend menu as shown below.

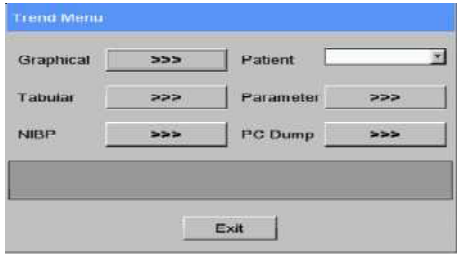


Figure 5.11

Graphical : Select this to view graphical representation of the selected parameters (not applicable for NIBP).

Duration : Select this to choose duration of required Graphical Trend data from drop down list.

Display : Select this to view the graphical trend of the parameters selected. *Planet 55* will display Graphical Trend screen as shown in Figure 5.11.

Scroll : Select this to scroll through the graphical trend.

Zoom : Future upgrade

Exit : Select this to return to the Graphical Trend Duration menu.

Exit : Select this to return to the Trend menu.

Figure 5.12

The Graphical Trend taken from the External Printer is as shown in the Figure 5.13.

----GRAPHICAL TREND----

DATE : 05 NOV 2006 TIME : 07:19

NAME : Patient68

ID NO: BED NO: SEX : F

AGE : 35Y 0M 0D WT : 60kg HT : 68inch

*PR SOURCE : SPO2 #PR SOURCE : NIBP *RR SOURCE : ECG

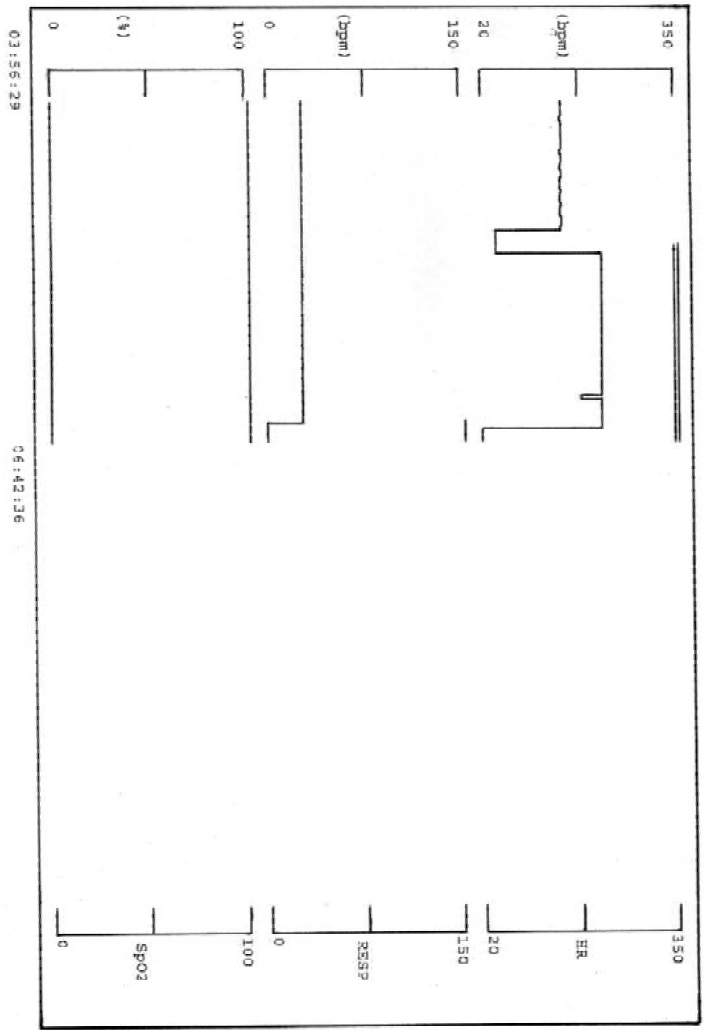


Figure 5.13

Tabular : Select this to view tabular representation of the selected parameters (not applicable for NIBP).

Resolution : Select this to choose resolution from the drop down list.

Display : Select this to view tabular trend of the parameters selected. *Planet 55* will display Tabular Trend screen as shown in Figure 5.14.

▲ : Select this to go to the previous page of the trend.

▼ : Select this to go to the next page of the trend.

Figure 5.14

Rec : Select this to record the current page of the tabular trend.

Exit : Select this to return to the Tabular Resolution menu.

Exit : Select this to return to the Trend menu.

The Tabular Trend taken from the External Printer is as shown in the Figure 5.15.

- - - -TABULAR TREND- - - -

DATE : 05 NOV 2006 TIME : 03:55
NAME : Patient 67
ID NO : BED NO : SEX : F
AGE : 1Y 1M 1D WT : 1Kg HT :
*PR SOURCE : SpO_2 # PR SOURCE : NIBP *RR SOURCE : ECG

DATE	TIME HH : MM : SS	HR (bpm)	RESP (bpm)	SpO2 (%)
05 NOV 2006	07 : 17 : 54	84	22	95
05 NOV 2006	07 : 17 : 49	86	20	93
05 NOV 2006	07 : 17 : 44	85	20	95
05 NOV 2006	07 : 17 : 39	84	22	95
05 NOV 2006	07 : 17 : 34	84	24	98
05 NOV 2006	07 : 17 : 29	80	23	95

Figure 5.15

NIBP : Select this to view the stored NIBP readings along with parameters selected.

Parameter1 : Select this to choose any one of the parameters for which the trend data required from the drop down list.

Parameter2 : Select this to choose any one of the parameters for which the trend data required from the drop down list.

Display : Select this to view tabular trend of the parameters selected. *Planet 55* will display NIBP Trend screen as shown in Figure 5.15.

▲ : Select this to go to the previous page of the trend.

▼ : Select this to go to the next page of the trend.

Rec : Select this to record the current page of the tabular trend.

Exit : Select this to return to the NIBP Parameter Selection menu.

Figure 5.16

Exit : Select this to return to the Trend menu.

Note

When the external USB Printer is connected with the monitor, internal recorder will be disabled. All prints will be obtained on the external printer. The data will be printed in internal recorder if printer is not connected.

Patient : Select this to choose patient name for which the trend data is required from drop down list.

Parameter : Select this to choose parameters from parameter selection panel for which the trend is required. Three parameters can be selected in the parameter selection panel at a time from drop down list.

Exit : Select this to save and return to the Trend menu.

PC Dump : Select this to Start / Stop PC Dump.

Start : Select this to download real time data of all parameter into the PC.

Stop : Select this to end the downloading process.

Exit : Select this to return to the Main screen.

PC Dump Application

PC Dump application should exist in the computer and will display the PC Dump menu as shown below.

Figure 5.17

Status : Displays Data dumping in progress / IDLE.
Change : Select this to choose the communication port.
Browse : Select this to choose the location of the file to be saved.
Exit : Select this to save and exit from the PC Dump application window.

The file will be saved as CSV format and can be opened in Microsoft ® Excel. The down loaded data is as shown below.

Patient Name:	X	ID:	123
Sex:	Female	Mode:	Adult
Adm_Date:	24/7/2007	Adm_Time	14:09:27

Date	Time	HR(bpm)	SpO2(%)	TEMP1(cent)	EtCO2(mmHg)
25/7/2007	8:56:08	-- *	FLT	FLT	FLT
25/7/2007	8:56:13	-- *	FLT	FLT	FLT
25/7/2007	8:56:18	-- *	FLT	FLT	FLT
25/7/2007	8:56:23	--	FLT	FLT	FLT
25/7/2007	8:56:28	-- *	FLT	FLT	FLT
25/7/2007	8:56:33	59*	75	FLT	FLT

Note

PC Dump application should exist in the computer.
Contact L&T authorised service personnel for installation of software.
Date and Time will be the default file name if the file name is not entered.

Display

Format 1	Format 2	Format 3	User Format	Exit

Planet 55 will display the Display Format panel as shown below.

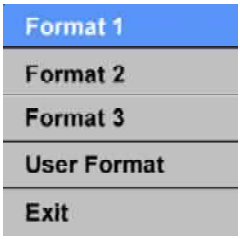


Figure 5.18

Format 1 : Select this to set the standard display format which includes ECG, SpO_2, CO_2, NIBP and Temp parameters.

Format 2 : Select this to set the standard display format which includes ECG, SpO_2, Resp (3 Lead setup) / CO_2 (5 Lead setup), NIBP and Temp parameters.

Note

Following waveforms will be displayed for ECG:
Lead II and Cascaded waveforms for 3 lead setup
Lead II and Chest Lead (V1) waveforms for 5 lead setup

Format 3 : Select this to set the standard display format which includes ECG (Lead II), NIBP, SpO_2 and Temp.

User Format : Select this to view or edit pre-configured user defined display formats.

Display : Select this to view the pre-configured user defined display formats.

Edit : Select this to edit the pre-configured user defined display formats. Three main display formats can be configured by the user. *Planet 55* will display the User Format menu as shown below

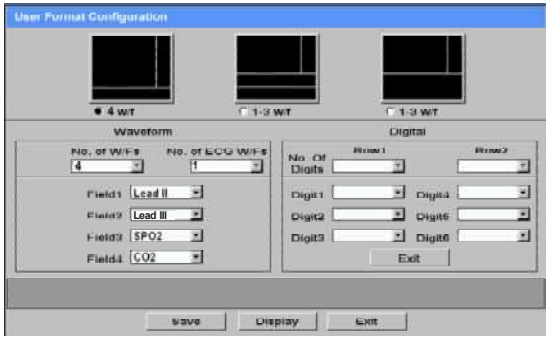


Figure 5.19

User Format1 : Select 4 parameters in the Waveform field and number of ECG waveforms i.e, Field 1 to Field 4 from the dropdown list.
Select 2-3 parameters in the Digital field i.e, Digit1 to Digit3 from the dropdown list.

User Format2 : Select 1-3 parameters in the Waveform field and number of ECG waveforms i.e, Field 1 to Field 3 from the dropdown list.
Select 2-3 parameters for each row in the Digital field i.e, Digit1 to Digit6 from the dropdown list.

User Format3 : Select 1-3 parameters in the Waveform field and number of ECG waveforms i.e, Field 1 to Field 3 from the dropdown list.
Select 2-3 parameters in the Digital field i.e, Digit1 to Digit3 from the dropdown list.

Note

No. of Digits field has four options:
2 Digit / 3 Digit / LW, SW and SW, LW
where, SW - Small Window
LW - Large Window

Save : Select this to save the changes user defined display formats.

Display : Select this to view the pre-configured user defined display formats.

Exit : Select this to return to the Display Menu.

Exit : Select this to return to the Display Menu.

Exit : Select this to return to the Main screen.

Volume

Planet 55 will display the Volume Setup menu as shown below.

Alarm Vol	Beep Vol	Exit

Figure 5.20

Alarm Vol : Select this to adjust alarm volume. *Planet 55* will display volume menu.

▲ : Select this to increase the alarm volume.

▼ : Select this to decrease the alarm volume.

Exit : Select this to return to the Volume Setup menu.

Beep Vol : Select this to adjust beep volume. *Planet 55* will display volume menu.

▲ : Select this to increase the beep volume.

▼ : Select this to decrease the beep volume.

Exit : Select this to return to the Volume Setup menu.

Exit : Select this to return to the Main screen.

Recall

▲	▼	Rec	Exit

Select this to recall last 24 patient related alarm conditions in tabular format. *Planet 55* will display the Recall Setup menu as shown below.

Figure 5.21

▲ : Select this to go to the previous page.

▼ : Select this to go to the next page.

Rec : Select this to record the current page.

Exit : Select this to return to the Main screen.

Autoset

Select this to set alarm limits for all the parameters (except for NIBP) .

6

MAINTENANCE SCHEDULE

Notes:

Routine Maintenance

L&T products have been designed to operate continuously with minimum maintenance.

However, in order to ensure better performance and safety, the routine maintenance should be performed. A summarized schedule and full details of this maintenance is covered in this section.

Caution

Maintenance involving removal of the outer case or access covers must not be attempted by the operator, but referred to a Qualified L&T medical's representative.

Following action should be carried out in routine maintenance. Aestrix (*) indicate that the following action is required.

Action	General	ECG, SpO_2, Temp, NIBP
	A	**B**
1. Check patient connections and accessories		*
2. Cleaning and sterilization of accessories		*
3. Clean monitor exterior	*	
4. Check power cord	*	
5. Check battery	*	
6. Check monitor operation	*	*
7. Check monitor calibration		*

Action Details

1B) Leads, sensor and probes should be carefully checked for any signs of damage. Damaged leads should be replaced. Do not attempt to repair.

2B) All accessories must be cleaned before use. Following precautions must be observed while cleaning and sterilizing of accessories.

Cleaning

WARNING

Do not use sharp instrument for cleaning cables.

ECG:

a. ECG leads should be cleaned with a cloth slightly moistened with soap water. Always allow the cable to dry thoroughly before use.
b. Clean blood from all external surfaces.

SpO_2, NIBP and Temp:

Refer relevant accessory instruction leaflet provided along with the accessories for any specific cleaning procedures.

Sterilization

ECG:

a. Clean as detailed above.
b. Wrap the connector lead in a polythene bag to prevent moisture penetration.
c. Loosely coil the cable to avoid any kinks.
d. Wrap cable in the recommended way for ethylene oxide sterilization.

SpO_2, NIBP and Temp:

Refer relevant accessory instruction leaflet provided along with the accessories for any specific sterilizing procedures.

3A) Isolate equipment from mains supply before cleaning. Clean the case and front panel with a soft cloth lightly moistened with warm soap water. Use only mild soaps or detergents. Allow the machine to dry thoroughly before use. Do not use chemicals or abrasive cleaning agents.

Note

On accidental wetting of the monitor,

1. Wipe the surface of the monitor with a clean and dry cloth.
2. If the monitor malfunctions, refer the monitor to L&T authorized service personnel.

4A) Inspect the power cord for any signs of damage to cable or connectors. If damaged, replace with a L&T replacement part. Do not attempt to repair.

5A) Isolate monitor from the mains supply. Switch ON the monitor and observe the battery status area in the display. If that area blinks with red colour, connect monitor to mains supply. Leave the unit for charging. If low battery indication still remains on the screen,refer the monitor to service personnel for battery replacement.

6AB) Connect the power cable to the mains supply, switch ON the monitor and check the following:

Caution

Batteries will be permanently damaged if left discharged.

- Adjustment of alarm volume.
- Adjustment of Beep volume.
- Adjustment of alarm limits. Enabling and disabling of individual alarms.
- Operation of alarm functions.
- Operation of recorder functions (optional).
- Operation of fault function (patient cable disconnected).
- Selection of trace speed for ECG and SpO_2.
- Selection of waveform parameters.
- Selection of graphical/tabular trend view.
- Selection of ECG, Resp and SpO_2 gains.
- Selection of SpO_2 response.
- Selection of TEMP unit (either ^0C or ^0F).
- Selection of NIBP mode.
- Selection of CO_2.
- Return all adjustments to the desired settings after the checks.

7B) Perform the following checks to ensure that the monitor is calibrated correctly.

i. ECG

- Select CAL option from the menu list of ECG and observe the display.
- Square pulses will be produced of 1mV amplitude.

Note

ECG CAL is associated for Lead II, III and V for 5Lead and Lead II and III for 3Lead ECG cable.

ii. Temperature

- Select Cal option from the menu list of Temp and observe the display.
- T will read 98.6 ^{0}F or 37 ^{0}C.

Capnography Maintenance Schedule

- Sample line is disposable and single use only.
- Incase of any water condensation in sample line please replace the sample line with a new one.
- Check the accessories before use.
- Use specified accessories only.
- CO_2 module should be calibrated every one year or 4000 hours of usage, which ever is earlier. This calibration should be done by authorized L&T personnel.

Note

Use L&T authorised accessories and batteries only.

Capnography Maintenance Schedule

- Use specified accessories only.
- Check the accessories before use.
- Sample line is disposable and for single use only.
- Incase of any water condensation in sample line, replace the sample line with a new one.
- CO_2 module should be calibrated once in a year or 4000 hours of usage, which ever is earlier. This calibration should be done by authorized L&T personnel. The calibration must be performed with a manufacturer approved calibration kit. The manufacturer approved calibration kit must be purchased from Scott Medical. Calibration gas contains 5% CO2, 21% O2 and balance N2. Switch ON the Monitor.

Procedure for calibrating Capnography Module

- Switch ON the monitor.
- Go to set up screen by pressing optical encoder during self test.
- Press **CO_2 CAL** from the **Setting** menu.
- Connect filter line from calibration kit to the monitor.
- Press start **CAL** and **Confirm** for further proceedings.
- Message " Keep pressing cylinder knob to deliver the gas" will display. Press the knob of the cylinder kit and select **OK**.
- Message "Calibrating... Please wait" will display.
- Message "Calibrating ... Please remove gas" will display.
- After calibration , message "Calibration succeded" will display
- Remove filter line from the monitor.

Check the last calibrated date in Menu ⟶ System ⟶ All Info

Recorder Paper Replacement

Figure 6.1

The instructions below describe the replacement of recorder paper. Use only recommended recorder paper. This ensures that the print quality is acceptable and reduces print head ware.

Step 1: Press and open the recorder cover as shown in the Figure 6.1.

Step 2: Remove empty paper spool by pulling it out gently.

Step 3: Insert new paper roll into the paper holder with the sensitive (shiny) side of the paper facing the print head at the top of the recorder.

Step 4: Unroll approximately 4 inches of paper.

Step 5: Align the paper across the top of the metal bar.

Step 6 : Holding the paper in place, close the recorder cover.

Step 7 : To ensure that the paper is aligned properly and has not been pinched in the recorder, pull the loose edge out a couple of inches. If the paper jams, open the recorder cover and return to Step 5.

7

ACCESSORIES

Notes:

ECG

Planet 55 offers 3 lead ECG monitoring facility.

- 3 lead ECG cable (I, II, III)
- 5 lead ECG cable (I, II, III, aVR, aVL, aVF, V)

Figure 7.1 : 3 Lead ECG Cable

Figure 7.2 : 5 Lead ECG Cable*

Respiration

Respiration can be monitored through same ECG cables 3/5 lead or through Capnography. Priority for respiration is given to Capnography, if the option is installed.

Figure 7.3: 3 Lead ECG Cable

Figure 7.4: 5 Lead ECG Cable*

Figure 7.5: Filter Line Adult Adult Paediatric

Note

- ECG RESP can be measured only through 5 Lead ECG Mode, if Capnography is installed.
- ECG RESP can be measured either through 5 Lead or 3 Lead ECG Mode, if Capnography is not installed.

* Optional

Temperature

Planet 55 is compatible with YSI 400 series of temperature probes.

YSI 401 : Rectal/Oesophageal temperature probe (Adult).
YSI 402 : Rectal/Oesophageal temperature probe (Neonatal).
YSI 409A : Tape-on skin probe.

Figure 7.6 : Rectal/Oesophageal Temperature Probe (Adult)*

Figure 7.7 : Rectal/Oesophageal Temperature Probe (Neonatal)*

Figure 7.8 : Tape-on Skin Probe*

* Optional

Pulse Oximetry

Accessories for Pulse Oximeter

- DS 100™ (DURA SENSOR) from NELLCOR for adults application (patients above 40 Kg).
- DURA Y™ for universal application (patients above 1 Kg to 80 Kg).
- Extension cable.

Figure 7.9 : DS 100™

Figure 7.10 : Dura Y™ *

Figure 7.11 : Extension Cable

* Optional

Non Invasive Blood Pressure

NIBP basic configuration comprises of following accessories:

- Adult cuff (14 cm x 37 cm) (Reusable)
- Child cuff (9 cm x 27 cm) (Reusable)
- Neonate cuff (3 cm x 9 cm) (Disposable)
- Hose tube (3 meters) (Reusable)

Figure 7.12 : Adult Cuff

Figure 7.13 : Child Cuff

Figure 7.14 : Neonate Cuff

Figure 7.15 : Hose Tube

Capnography (Optional)

Following accessories are provided for Capnography (microstream) along with *Planet 55* monitor.

- Capno Line
  - Adult
  - Paediatric
  - Infant - Neonate

Figure 7.16 : Capno Adult

Figure 7.17 : Capno Paediatric

Figure 7.18 : Capno Infact - Neonatal

- Filter Line
  - Adult / Paediatric
  - H set Adult / Paediatric
  - H set Infant / Neonatal

Figure 7.19 : Adult / Paediatric Filter Line

Figure 7.20 : H Set Adult / Paediatric Filter Line

Figure 7.21 : H set Infant / Neonatal Filter Line

Grounding Cable

Figure 7.22 : Grounding Cable

Standard Accessories

ECG	3 Lead Cable
SpO_2	Durasensor
	SpO_2 Extension Cable
NIBP	NIBP Hose
	Adult Cuff

Optional Accessories

ECG	5 Lead Cable
CO_2	Capnoline H - Infant/Neo
	Capnoline H - Adult
	Capnoline H - Pediatric
	Filterline Set Adult/Pediatric
	Filterline H - Set Adult/Pediatric
	Filterline H - Set Infant/Neonatal
Temperature	Rectal/Esophageal probe - Adult
	Rectal/Esophageal probe - Neonatal
	Tape on skin probe
SpO_2	Dura Y Sensor

8

TROUBLESHOOTING AND WAVEFORMS

Notes:

Troubleshooting Chart

Problems	Cause	Corrective Action
No display, mains not available.	Mains supply not OK.	Change the plug point. If problem persists, call L&T authorized service personnel.
	Fuse blown.	Call L&T authorized service personnel.
No audio alarm	Alarm is disabled	Enable alarm.
Low battery indication on screen.	Battery is getting discharged. Monitor will stop functioning in few minutes.	Connect the unit to mains and allow the battery to charge.
No QRS tone	QRS volume set to minimum.	Adjust beep volume.
Poor ECG waveform	Electrode sites are incorrect.	Clean the area and resite the electrodes.
	Poor electrode contact.	Resite electrodes.
	Dried electrodes.	Remove electrodes. Apply gel and reattach properly.
	Faulty ECG cable.	Replace patient cable.
Noise in ECG trace area	Noise pickup due to improper grounding.	Check the mains plug for proper ground connections. Check that grounding cable is connected properly.
Poor respiration waveform	Electrode sites RA-LA/ RA-LL are incorrect.	Clean the area and resite electrodes.
	Poor electrode contact.	Resite electrodes.
	Dried electrodes.	Remove electrodes. Apply gel and reattach properly.
	Faulty ECG cable.	Replace ECG cable.
Respiration alarms not responding.	Respiration alarm is disabled.	Enable the alarm.
Monitor is not responding when SD Card connected	SD Card not detected	Format the SD Card through file system in PC. If still problem persists, change the SD Card.
Not getting download/ upload the trend / monitor settings.	SD Card not functioning properly	Format the SD Card through Monitor and Check for functioning. If still problem persists change the SD Card.

Problems	Cause	Corrective Action
After NIBP measurement is taken, unit displays (- -) in NIBP readings box.	Cuff not connected properly.	Check cuff for proper connection and position. The cuff must be properly wrapped around the limb and must not be loosely attached.
Temperature alarms not responding	Alarm is disabled	Enable the alarm.
Not recording and red indicator in recorder module is blinking.	Recorder paper roll empty.	Insert recorder paper roll.
	Recorder cover is open	Close the recorder cover.
	Recorder module not connected.	Call L&T authorized service personnel.

Error Messages

Problem	Cause	Corrective Action	Alarm Type
ECG			
↑	Patient HR / PR value exceeding higher alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
↓	Patient HR / PR value below the lower alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
Check HR	The difference between PR from SpO2 and HR from ECG is more than 30 BPM.	Patient needs medical attention. NA	NA
HR-RR coincidence	The difference between HR and RR is less than 30 BPM.	Patient needs medical attention. NA	NA
Communication Error	Module not responding.	Call L&T authorized service personnel.	TA
Leads OFF	Cable not connected properly to the unit.	Connect the cable properly to the unit.	TA
Fault messages i. LA Fault ii. RA Fault iii. LL Fault iv. RL Fault v. CL Fault	Respective leads are disconnected from the patient.	Connect respective leads properly.	TA
Respiration			
↑	Patient RR value exceeding higher alarm limit.	Patient needs medical attention. (Acknowledge the alarm). Reset the limit, if require.	PA
↓	Patient RR value below the lower alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
Fault	RA-LA or RA-LL leads are not connected properly to the patient.	Connect the leads properly to the patient.	TA

Problem	Cause	Corrective Action	Alarm Type
Temperature			
↑	Patient Temperature value exceeding higher alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
↓	Patient Temperature value below the lower alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
OFF	Cable not connected properly to the unit.	Connect the cable properly to the unit.	TA
-?-	Range has exceeded.	Patient needs medical attention.	NA
SpO_2			
↑	Patient SpO_2 value exceeding higher alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
↓	Patient SpO_2 value below the lower alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
Check Probe Site	Sensor not connected properly to the patient.	Connect the sensor properly to the patient.	PA
Sensor OFF	Cable not connected properly to the unit.	Connect the cable properly to the unit.	TA
Communication Error	Module not responding.	Call L&T authorized service personnel.	TA

Problem	Cause	Corrective Action	Alarm Type
NIBP			
↑	Patient systolic pressure value exceeding higher alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
↓	Patient systolic pressure value below the lower alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
↑	Patient diastolic pressure value exceeding higher alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
↓	Patient diastolic pressure value below the lower alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
Time Exceeded	Measurement time exceeded.	Restart the NIBP measurement.	TA
Air leak	Removal of NIBP tube from the unit. Leakage in tube or cuff.	Check the connections and tighten if required. Replace the tube or cuff if required.	TA
Pneumatic Blockage	Bent or block in NIBP tube.	Replace the tube if required.	TA
Over Pressure	Use of inappropriate cuff.	Use the appropriate cuff.	TA
Loose Cuff	Cuff is loosely wrapped.	Wrap the cuff properly.	TA
Cuff Position Error	Cuff placement is not at the proper position.	Place the cuff in proper position.	TA
Communication Error	Module not responding.	Call L&T authorized service personnel.	TA

Problem	Cause	Corrective Action	Alarm Type
CO_2			
↑	Patient $EtCO_2$ value exceeding higher alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
↓	Patient $EtCO_2$ value below the lower alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
↑	Patient $FiCO_2$ value exceeding higher alarm limit.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA
CO_2 No tubing	Sample line not connected to the unit.	Connect sample line to the unit.	TA
CO_2 Purging	Sample line blocked.	Change the sample line.	TA
Change sample line	Purging continues for more than 30 Sec.	Change the sample line.	TA
No breath	RR is zero.	Patient needs medical attention (Acknowledge the alarm). Reset the limit, if require.	PA

Note

Physiological Alarms (PA) and Technical Alarms (TA) are should be treated as High Priority and Medium Priority alarms respectively.

Message displayed in white message area

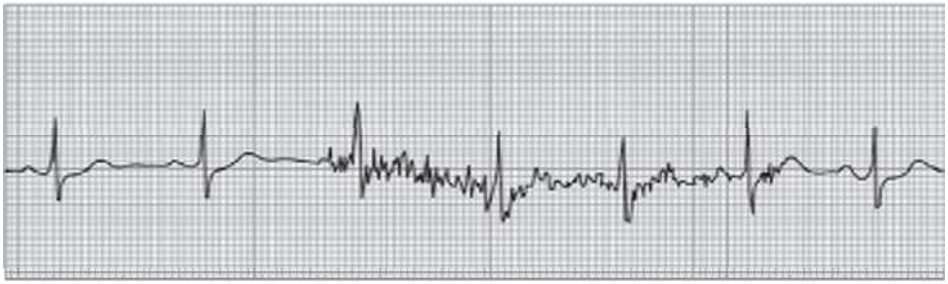
Parameter	Message	Condition	Display Position
CO_2	Initializing CO_2	Module Initialization	Real time Screen.
CO_2	Module Not ready	Module Not Ready for calibration.	Service screen.
CO_2	Calibration Success	Calibration is successful.	Service screen.
CO_2	Calibration Error	Calibration failed	Service screen.
CO_2	CO_2 Warm Up	When the CO_2 module is preparing itself for operation	Service screen.
CO_2	CO_2 Ready	Before the first measurement of CO_2, after the filterline is connected, and before patient breathing is sensed, "CO_2 Ready" will replace the "CO_2 Warm-up" message.	Real time Screen.
CO_2	CO_2 Cal Reqd.	Shown if CO_2 calibration is overdue.	Real time Screen.
CO_2	CO_2 Maintenance Reqd.."	Shown if CO_2 maintenance is overdue.	Real time Screen.
CO_2	Auto Zeroing	During auto zeroing on calibration((Module sends the request for zeroing and automatically zeroing command is sent from the host to the module.)	Real time Screen

Parameter	Message	Condition	Display Position
RR/ CO_2	No Breath	When there is no breath detected.	Real time screen
HR/PR	Check HR	Difference between HR (from ECG) and PR (taken from SPO2) is more than 30.	Real time screen
	HR-RR-coincidence	When HR and RR alarm difference is less than 30.	Real time screen
RR	No Breath	When RR value is zero and RR source is CO_2	Real time screen
PC Dumping	PC Dumping	During data dumping	Real time screen

Problems Observed During ECG Monitoring

Patient Related

A. Involuntary Movement



Graph 8.1

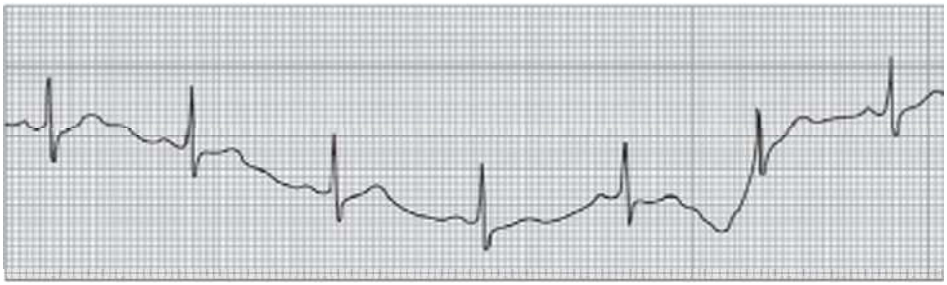
Identification:

Muscle movement near the electrodes generates myoelectricity or additional background electrical patterns. Notice the irregular height and width of the spikes.

Corrective Action:

Involuntary movement is usually a result of patient discomfort and is caused by chill or muscle tremors, coughing or other nervous reactions. Assuring the patient that the procedure will not hurt and setting his mind at ease will help relieve natural anxieties. Ensure the room temperature is warm enough for the patient.

B. Voluntary Movement



Graph 8.2

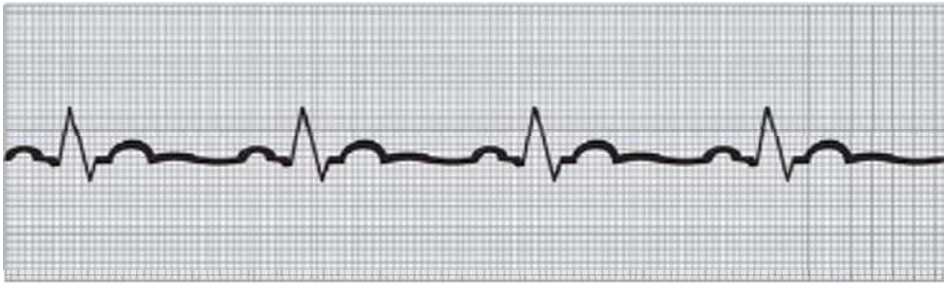
Identification:

Gross body movement will cause base line deviation. The signal will be present but, there will be baseline wanders. Myoelectricity may be present as well.

Corrective Action:

The patient should be comfortable and relaxed. Again, reassuring the patient that the monitoring will not hurt him, will restore confidence. Usually voluntary movement is of short duration. Normal ECG waveform will return when movement stops. If severe artifact results from slightest body movements, check the electrode application.

C. Poor Skin Preparation



Graph 8.3

Identification:

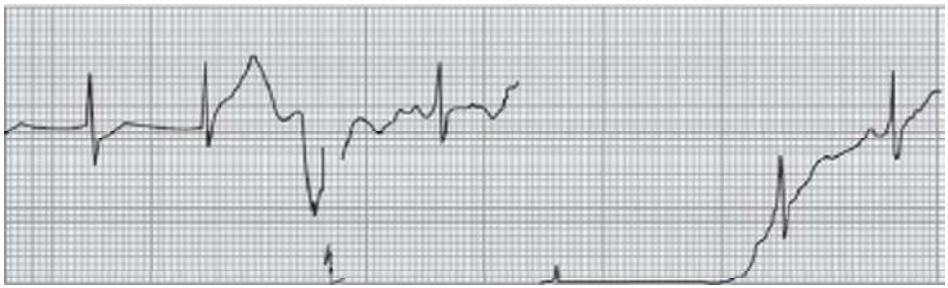
Failure to prep a patient with oily skin will cause low amplitude, wandering base line and 60 Hz frequency interference. Poor skin preparation may not show problems immediately, but effects the signal in long term monitoring.

Corrective Action:

Cleaning the body oils and dead tissues are essential for proper adhesion and contact of electrodes. The prep area should includes the electrodes site under the adhesive as well as the contact area. Preferred scrub solutions for skin preparation are: abrasion, special detergent solutions and saline wash. While using solutions, ensure that the area is dried before the application of electrodes.

Electrodes Related

A. Loose Electrode



Graph 8.4

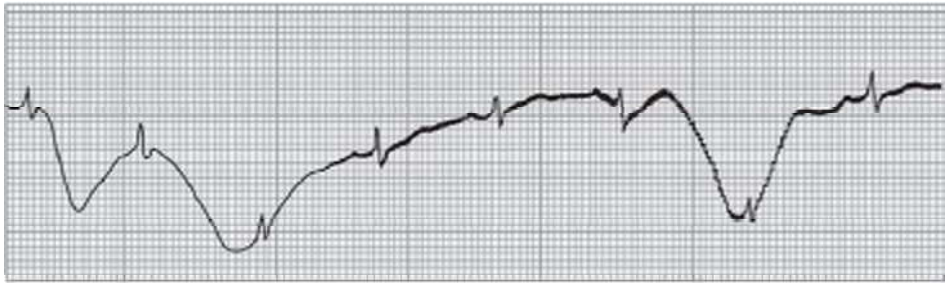
Placement on bony area:

Electrode placed on a bony area will show abrupt base line deviation or complete loss of signal. A loose electrode usually have a full amplitude signal with several artifacts. It also happens if electrodes are not placed properly.

Line Transients : When electrodes or lead wires are loose or detached, the transients may be transmitted to the monitor through patient cable and can resemble ECG waveform. This may also inhibit heart rate alarms and may indicate false information.

Corrective Action:

Electrodes should be placed on fleshy areas which will help to place electrodes properly. Check that the patient cables are not pulling the electrodes and the electrode is attached properly to the body of the patient.



Graph 8.5

B. Dried Out Electrode

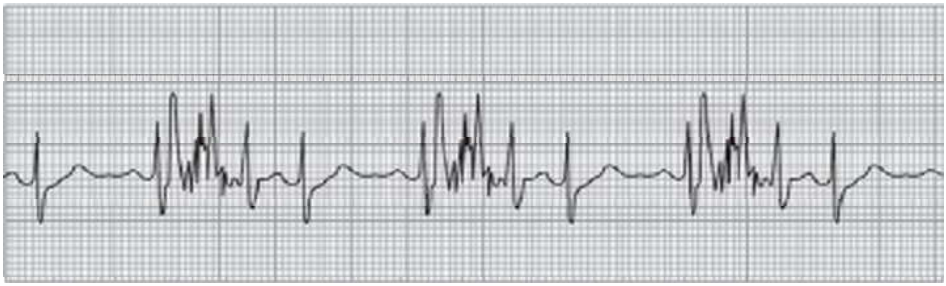
Identification:

This signal usually degenerates with time. Characteristics such as low amplitude, diphasic QRS complexes, 60 Hz frequency interference and base line wander will usually be present.

Corrective Action:

Check the electrode to make sure that the electrolyte is moist and is in sufficient quantity and is in proper contact with the electrode and skin.

Equipment Related



Graph 8.6

A. Poor Connection

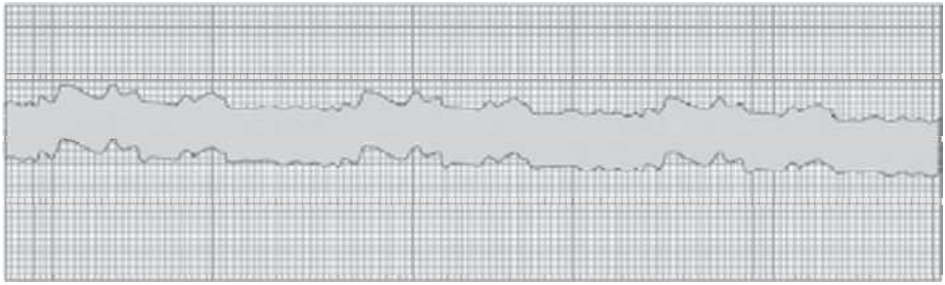
Identification:

Poor connection will indicate muscle artifact on entire trace.

Corrective Action:

Check lead wires, junction of cable and electrode to ensure proper connection.

B. Broken Lead Wire



Graph 8.7

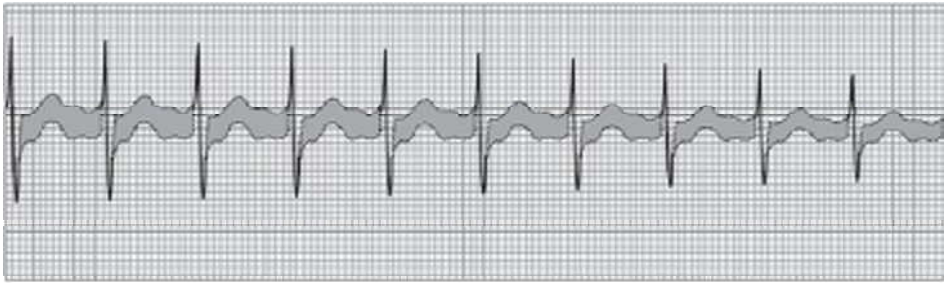
Identification:

Broken lead wire or completely detached electrode will cause pure 60 Hz frequency interference. The QRS complex is almost masked by the extremely wide base line.

Corrective Action:

Check the lead wires, cables and connections. Replace with new cable if required. The use of shielded cables is recommended, to protect lead wires from interfering current.

C. Bad Grounding



Graph 8.8

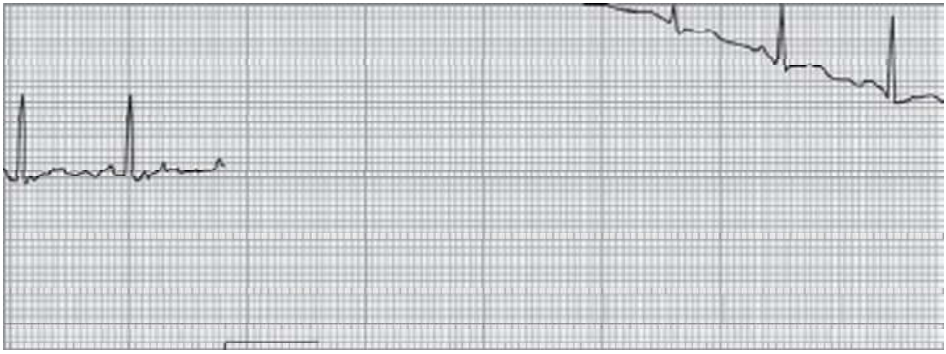
Identification:

Bad grounding may cause 60 Hz frequency interference which is distinguishable because of wide base line.

Corrective action:

Bad grounding may also create a shock hazard. If grounding is doubtful, request for an electrical maintenance check. TV sets, electrical cords and fluorescent bed lamps near the bed may also cause 60 Hz frequency interference.

D. Static Electricity



Graph 8.9

Identification:

Static electricity may throw the trace off the screen abruptly. The trace will gradually recentre itself within few seconds.

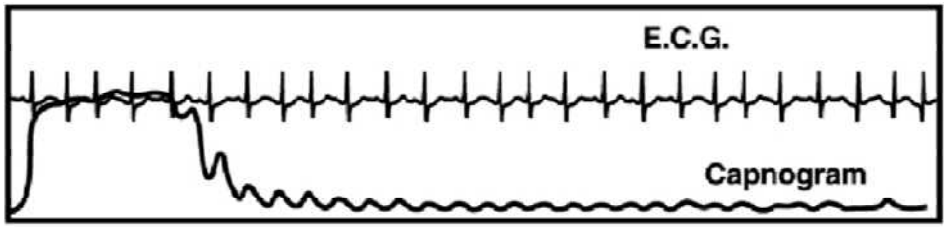
Corrective Action:

Synthetic fabrics in bed sheets and clothing may generate static electricity. This can disturb the trace abruptly without patient movement, especially when cables without proper shieldings are used.

Problems Observed During CO_2 Monitoring

Cardiogenic Oscillations:

Cardiogenic oscillations appears during the final phase of the alveolar plateau and during the descending limb. They are caused by the heart beating against the lungs.



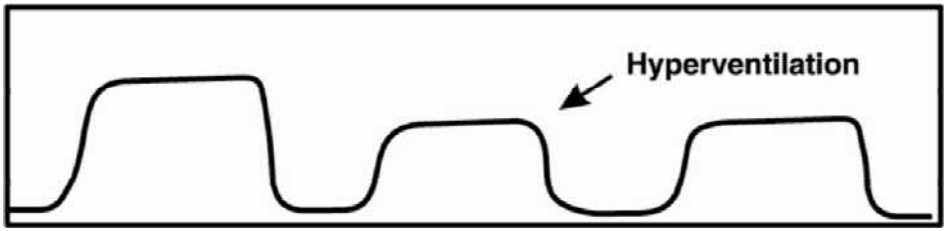
Graph 8.10

Characteristics:

a. Rhythmic and equal to heart rate
b. May be observed in pediatric patients, mechanically ventilated at low respiratory rates with prolonged expiratory times.

Hyperventilation

An decrease in the level of the End Tidal CO_2 from previous levels.



Graph 8.11

Possible Causes:

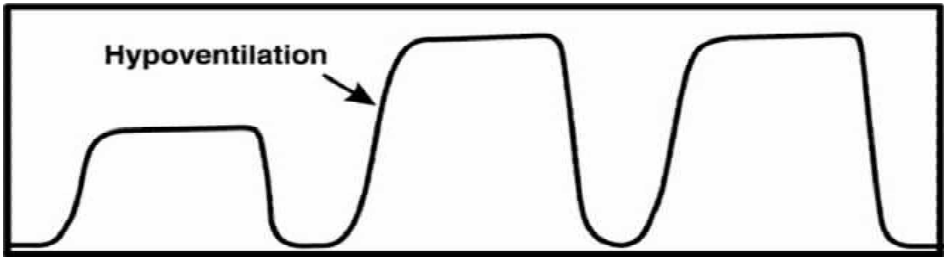
a. Increase in respiratory rate
b. Increase in Tidal volume
c. Decrease in metabolic rate
d. Fall in body temperature

Note

Exponentially decrease in CO_2 can also be because of cardiac arrest or severe hypotension (massive bleeding).

Hypoventilation

An increase in the level of the End Tidal CO_2 from previous levels.



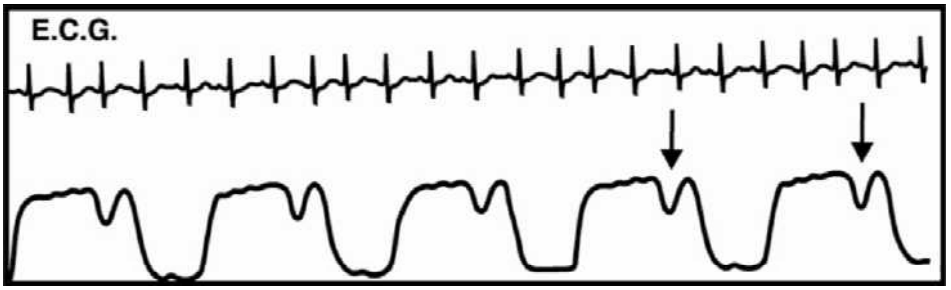
Graph 8.12

Possible Causes:

a. Decrease in respiratory rate
b. Decrease in tidal Volume
c. Increase in metabolic rate
d. Rapid rise in body temperature (malignant hyperthermia)

Muscle Relaxants

Clefts are seen in the final third portion of the alveolar plateau. They appear when the action of the muscle relaxants are affected by spontaneous ventilation.



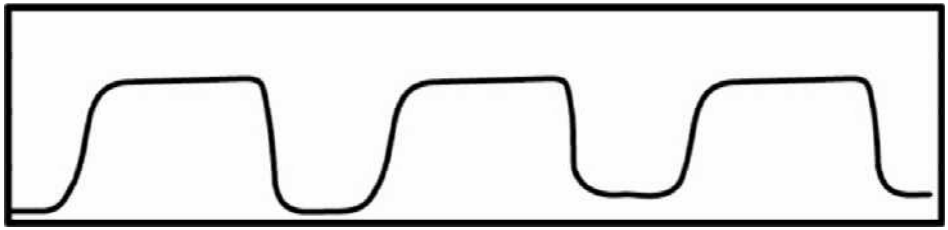
Graph 8.13

Characteristics:

a. Depth of the cleft is inversely proportional to the degree of drug activity
b. Position fairly constant on same patient but may not be present in every capnogram.

Rebreathing:

Rebreathing is characterized by an elevation in the baseline with a corresponding increase in End Tidal CO_2. It indicates the rebreathing of the previously exhaled CO_2.



Graph 8.14

Possible Causes:

a. Insufficient expiratory time
b. Faulty expiratory valve
c. Inadequate inspiratory flow
d. Malfunction of a CO_2 absorber system
e. Partial rebreathing circuits.

Obstruction in Breathing Circuit or Airway

An obstruction to the expiratory gas flow noted as a change in the slope of the ascending limb of the capnogram. The expiratory portion may diminish without a plateau.

Graph 8.15

Possible Causes:

a. Partial obstruction in the expiratory limb of the breathing circuit
b. Presence of a foreign body in the upper airway
c. Partially kinked or occluded artificial airway
d. Herniated endotracheal/tracheostomy tube cuff
e. Bronchospasm

Endotracheal Tube Kinked

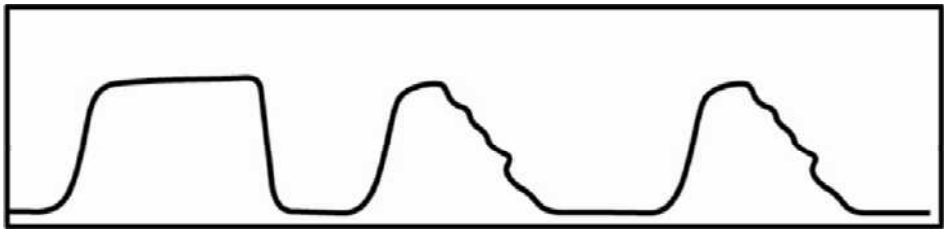
Graph 8.16

Waveform Evaluation:

a. Any obstruction will cause an abrupt change in the ascending limb resulting in either a diminished plateau or no plateau. $EtCO_2$ and slope will depend on the degree of obstruction.

Inadequate Seal Around Endotracheal Tube

A Capnogram in which the downward slope of the plateau blends in with the descending limb.



Graph 8.17

Possible Causes:

a. A leaky or deflated endotracheal or tracheostomy cuff
b. An artificial airway that is too small for the patient

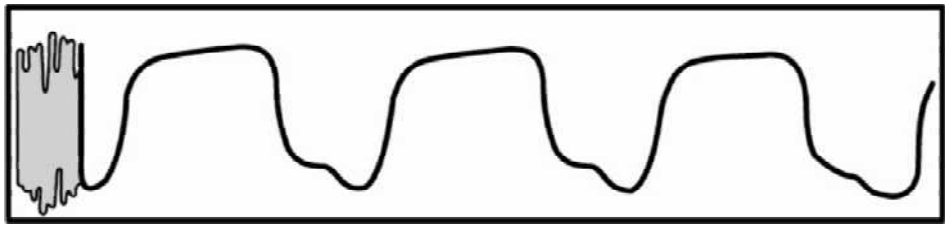
Endotracheal Tube in Oesophagus

Graph 8.18

Waveform Evaluation:

a. A normal capnogram is the best available evidence that the Et tube is correctly positioned and that ventilation is occurring. When the Et tube is placed in the oesophagus, either no CO_2 is sensed or any small transient capnograms are present.

Faulty Ventilator Circuit Valve

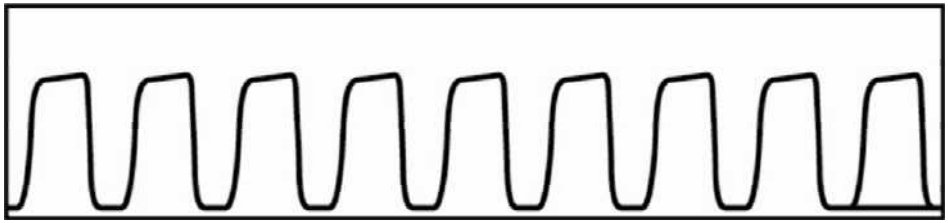


Graph 8.19

Waveform Evaluation:

a. Baseline elevated
b. Sloping descending limb of capnogram
c. Allows patient to rebirth exhaled gas.

Paediatric Capnogram



Graph 8.20

Typical Capnogram for a Paediatric Patient.

9

TECHNICAL SPECIFICATIONS

Notes:

System Specification:

1. Equipment Classification:

Mode of operation	:	Continuous
Degree of mobility	:	Portable
Types of protection against electric shock	:	Class 1
Degree of protection against electric shock	:	Type CF- ECG, Temperature, Respiration, Type BF- NIBP, SpO_2 and Capnography (all with defib protection)
Degree of protection against hazards of explosion	:	Not protected
Degree of protection against ingress of liquids	:	Drip proof - IPX1

2. Power Supply:

Input voltage	:	95-265V AC, 50Hz/60Hz $\pm$ 5%
Fuse	:	3.15A Fast blow
Indicator	:	Amber LED ON indicates Mains ON Green LED ON indicates Monitor ON Amber LED OFF and Green LED ON indicates Unit is ON in battery mode.
Current	:	0.7 A Max
Wattage	:	100 Watts

3. Battery:

Type	:	14.8 V (4AH / 8AH) Lithium ion
No. of battery	:	One pack Two packs
Charging time (min)	:	12 Hrs (One pack)
Discharge time	:	2/4 hrs

For 2 hrs backup:

One pack fully charged new batteries at 25 ^{0}C.

Discharge condition:

ECG, Resp, SpO_2, Temp, NIBP running at 15 min interval, without CO_2 and recorder printing.

For 4 hrs backup:

Two packs fully charged new batteries at 25 ^{0}C.

Discharge condition:

ECG, Resp, SpO_2, Temp, NIBP running at 15 min interval, without CO_2 and recorder printing.

Low battery indication voltage : 13.3 +/- 0.2V

Battery cut-off voltage : 12.2 +/- 0.2V

4. Indicator:

Green LED ON and Yellow LED OFF indicates Battery operation.

Green LED ON and Yellow LED ON indicates Mains operation and Battery charging.

Note

Monitor shows battery capacity at 2 instances:

1) When the monitor is operated on battery (Green LED ON and Yellow LED OFF) with no alarm condition, battery capacity is more than 20%.
2) When the monitor displays Low battery indication, the monitor continues to work for 10-15 mins depending upon the load on the battery. Monitor turns OFF when the battery reaches cutoff voltage.

5. Controls:

Front panel :
- 1 switch for unit ON/OFF control
- 1 switch for Goto
- 1 switch for NIBP start and stop
- 1 switch for Recorder
- 1 switch for Freeze and Defreeze
- 1 switch for Alarm acknowledgment
- 1 switch for Home screen
- 1 switch for Stand by
- 1 Optical Encoder with switch

6. Display:

Screen	:	8.4" color TFT display Dot Pitch 0.213 mm Active Display Area 170.4 (H) * 127.8 (V) mm (800H * 600V Dots)
Trace speed	:	6.25,12.5, 25 and 50 mm/sec for ECG, SpO_2, Respiration / CO_2
SpO_2 strength indicator	:	Bar graph showing the pulse strength
Waveform sampling rate	:	400 samples/sec for ECG (max) 100 samples/sec for SpO_2 (fixed) 100 samples/sec for Respiration (fixed) 10 samples/sec for Capnography
Recording indication	:	Recording... message in the message area indicate recording in progress
Alarm detection status	:	Crossed Bell symbol shown if disabled

7. Trends:

Data storage	:	5 sec for 72 hrs
HR, SpO_2%, TEMP1, RESP, $EtCO_2$, $FiCO_2$, TEMP2	:	72 hrs graphical and Tabular trend
NIBP	:	Last 240 readings will be displayed in tabular format
Graphical trend:		
Time scales	:	2 Hrs, 4 Hrs, 12 Hrs, 18 Hrs, 24 Hrs, 48 Hrs and 72 Hrs
View resolution	:	30 sec, 1 min, 3 min, 4.5 min, 6 min, 12 min and 18 min (respectively)
Tabular trend view resolution	:	5 sec, 10 sec, 15 sec, 30 sec, 1 min, 2 min, 4 min and 8 min
Alarm trend (Recall)	:	Tabular trend for display of last 24 patients alarms
Auto setting of alarms	:	Provided for HR, SpO_2, Temp1, Temp2, Respiration, $EtCO_2$, $FiCO_2$

Formula Used:

HR high limit	=	Present HR value X 8/10 + 76
HR low limit	=	Present HR value X 8/10 + 2

SpO_2 high limit	=	100
SpO_2 low limit	=	(Present SpO_2 value – 8) OR 80 (Whichever is greater)
Temperature high limit	=	Present T1 + 2
Temperature low limit	=	Present Temperature – 2
Respiration high limit	=	Present RR + 5
Respiration low limit	=	Present RR – 5
$EtCO_2$ high limit	=	Present value + 5
$EtCO_2$ low limit	=	Present value – 5
$FiCO_2$ high limit	=	Present value + 2
$FiCO_2$ low limit	=	0
RR high limit	=	Present value + 5
RR low limit	=	Present value – 5

Note

For NIBP auto set is not applicable.

8. Inputs:

Side panel	:	Nicolay type connectors for ECG / Respiration D-type for SpO_2 Female coupling for NIBP YSI connector for TEMP CO_2 filter line
Rear panel	:	Standard 3-pin IEC power connector Live and neutral lines protected by fuse

9. ECG:

Input	:	Isolated and floating 3/5 leads (depending on ECG cable). Protected against surges produced by ESU and defibrillator potentials.
Input Impedance	:	>2.5 M ohms at 10 Hz
CMRR	:	< 15 mm Max (Allowable noise on the screen for 3Vpp applied sine wave of 20 Hz)
Type of averaging	:	Moving window averaging
Patient applied risk current	:	< 10 μA (Isolated normal condition) < 50 μA (Isolated single fault condition)
Patient isolation risk current	:	< N/A (Isolated normal condition) 50 μA (Isolated single fault condition)
Overload recovery	:	< 8 sec
Fault indication	:	Individual lead fault detection
Cal	:	On screen cal indicator for all gains in a. Lead II, III and Chest Lead for 5 Lead b. Lead II and III for 3 Lead
Bandwidth	:	0.5 - 40 Hz for Monitoring mode 0.05 - 120 Hz for Diagnostic mode 0.5 - 20 Hz for OT mode
Gain	:	X0.2, X0.5, X0.75, X1, X2, X5,Auto -User selectable
Tall T wave rejection	:	Upto 1.2 mV or QRS amplitude (whichever is higher)
QRS beep volume control	:	12 steps (OFF to High)
Leads	:	3 leads for 3 lead ECG cable 5 leads for 5 lead ECG cable
QRS indicator	:	Beep and flashing heart symbol for every QRS complex detected

10. Heart Rate:

Range	:	20-350 BPM
Accuracy	:	2 BPM or 2% whichever is greater
Source of HR	:	ECG, SpO_2 and NIBP
HR Alarms	:	Adjustable alarm limits Upper 50 to 350 BPM Lower 20 to 320 BPM 4 seconds delay for HR alarms Time between the silencing of the alarm and reactivation is 14 seconds.
Heart rate meter response time	:	Change from 80 to 120 BPM (6 to 7 sec). Change from 80 to 40 BPM (11 to 12 sec).
Pacemaker pulse rejection/ detection capability	:	When pacer is ON the monitor will display the HR for all single and double pacemaker pulses either 150 or 250 msec apart, with a pulse width of 0.1 to 2 m sec and amplitudes ±2 mV to ±500 mV without overshoot. Lower threshold of slew rate for detection of pacer pulse is 2.2 V/s.

Note

Do not rely on the displayed HR value when pacer is OFF and pacer pulses are detected as QRS.

11. Respiration: (When source is from ECG)

Input	:	From ECG cable (RA-LA / RA-LL)
Leakage Current	:	<10 μA at 240V AC, 50 Hz
Excitation Current	:	<300 μA at 50 kHz
Sensitivity (Max)	:	0.2 Ohms/cm
Sensitivity (Min)	:	4 Ohms/cm
Range	:	0–150 BPM
Accuracy	:	Up to 30, $\pm$1 BPM, from 30 to 60 $\pm$2 BPM, >60 $\pm$ 4 BPM
Fault indication	:	Cable/Electrode fault indication
Gain	:	Options X1, X2, X3, X4 and Auto (User selectable)
No Breath Alarm Limit	:	10 - 90 sec (selectable) in steps of 5 Sec

12. Temperature:

Inputs	:	Isolated and floating
Leakage Current	:	<10 μA at 240V AC, 50 Hz
Measurement Range	:	0 ^{0}C to 50 ^{0}C
Scale value	:	Displays direct readings of Temperature input. 'ΔT' value displayed in place of T2.
Warm up	:	<10 min (Excluding probe)
Accuracy	:	±0.2 ^{0}C or ±0.4 ^{0}F
Alarms	:	Temperature limits adjustable Upper : 15.0 ^{0}C to 50.0 ^{0}C Lower : 12.0 ^{0}C to 47.0 ^{0}C
Unit	:	^{0}C or ^{0}F user selectable
Probe fault	:	Display shows 'OFF' if the probe not connected Display shows out of range condition (-?-) in the event of short circuit or open circuit probes Out of range condition also indicated if the Temperature raises above 50 ^{0}C or falls below 1 ^{0}C
Calibration	:	Injects signal of (37.0 ±0.1) ^{0}C into both inputs

13. SpO_2:

Tone variation with change in SpO_2	:	Provided
Measurement range	:	1 - 100%
Accuracy	:	Adults : (±1 Std. Dev.) 70 - 100% ±2 digits 0 - 69% unspecified Neonates : (±1 Std. Dev.) 70 - 100% ±3 digits 0 - 69% unspecified
Alarms	:	Adjustable alarm limits Upper : 55 to 100% Lower : 50 to 95%
Pulse rate range	:	20 to 250 BPM
Accuracy (± 1 Std. Dev.)	:	±3 BPM

14. Capnography (Microstream):

Measurement Range:

$EtCO_2$	:	0-99 mmHg
$FiCO_2$	:	0-20 mmHg
RR	:	0-150 BPM

Measurement Accuracy :

Time	CO_2 Partial pressure	Customer Accuracy
0-20 min	0-38 mmHg 39-99 mmHg	±4 mmHg ±12% of Reading
20 min and up	0-38 mmHg 39-99 mmHg	±2 mmHg ±5% of reading +0.08% for every 1 mmHg (above 38 mmHg)

- At sea level.
- Accuracy applies for breath rates of up to 80 BPM.
  For breath rates above 80 BPM, accuracy complies with EN 864/ISO 9918 (4 mmHg or ± 12% of reading whichever is Greater for EtCO2 values exceeding 19 mmHg. To achieve the specified accuracies for breath rates above 60 BPM, the Microstream@ neonatal airway adapter M1996A must be used in neonatal mode

Units	:	mmHg or kPa or Vol %
Scale	:	20, 40, 60, 80 and 100 mmHg or 2.6, 5.3, 8, 10.6 and 13.3 kPa/Vol%
Flow rate	:	50 ml/min
Warm up time	:	40 sec (Typical)
Alarms	:	

$EtCO_2$

Upper : 5 - 80 mmHg

Lower : 0 - 75 mmHg

$FiCO_2$

Upper : 2 - 20 mmHg

RR

Upper : 10 - 150 BPM

Lower : 5 - 145 BPM

Accuracy	:	0-70 (±1) BPM 71-120 (±2) BPM 121-150 (±3) BPM
Calibration	:	
Zero calibration	:	Automatically performed by the module. Indicated to the user through a message on the screen.
Calibration interval	:	Initially calibrate after 1200 operating hours, then once a year or after 4000 operating hours, whichever comes first.

Note

No Breath alarm limit is 10 - 90 with step of 5 sec.

15. NIBP:

Method	:	Oscillometric
Display	:	Systolic, Diastolic and Mean
Modes of measurement	:	Manual, Auto and Stat mode

- In Auto mode intervals of 2, 3, 4, 5, 10, 15, 30, 60 and 90 min are user selectable
- In Stat mode unit will take as many readings as possible in 5 min
- Duration between measurements is 10-12 sec

Unit (User selectable)	:	mmHg or kPa
Range	:	20 - 250 mmHg
Accuracy	:	±5 mmHg with a standard deviation not greater than 8 mmHg
Cuffs	:	Single quick connect hose
Auto zero	:	Zero pressure reference is automatically established after every reading
Cuff inflation	:	
Initial inflation	:	
Adult	:	160 mmHg
Neonates	:	90 mmHg
Pediatric	:	120 mmHg

Subsequent inflation approximately 30 mmHg greater than previous systolic pressure

Cuff deflation	:	Automatic
Alarms	:	Adjustable alarm limits (for both Sys and Dia)
		Upper : 30 to 250 mmHg
		Lower : 20 to 240 mmHg
Safety features	:	

Automatic deflation if, cuff pressure exceed

- 300 mmHg (Adult and Pediatric mode)
- 150 mmHg (Neonate mode)
- Measurement time exceeds more than 1 min to deflate

16. Alarms:

Accessory alarms	:	Audio (Alarm beep), Visual (Flashing Yellow LED and message indication)
Patient alarms	:	Audio (Alarm beep), Visual (Flashing Red LED alarms and message indication)
Re-alarm	:	3 min after an alarm is acknowledged
Alarms suspend	:	Continuous Yellow LED to indicate “Alarms Suspend” condition with display of alarm cross mark
SYNC	:	ECG waveform is displayed
Alarm volume control	:	12 steps (min to high)

17. Outputs (Optional):

ECG Sync	:	Provides 5V P-P pulse for synchronizing with defibrillator
External monitor	:	15 pin D-type sub connector (Female)
CNS communication	:	USB type
Ethernet	:	RJ45 type*
Nurse call	:	Stereo phono jack
PC Dump	:	9 pin D-type (Female)
Software upgrade and Printer	:	USB type
External memory storage	:	SD Card

* Future Upgrade

18. Recorder:

Recorder	:	Two channel
• Make	:	Woosim (Port - P40)
• Printing method	:	Thermal recording
• Dot density	:	203 DPI
• Paper Width	:	58 mm
• Printing Width	:	48 mm
• Speed	:	25 mm/sec
Recording modes	:	Direct, Delayed / Continuous modes On red alarm
Recording duration	:	Direct : 8 sec Delayed : -6 to +2 sec Continuous : 30 sec On alarm : -6 to +2 sec

19. Communication:

CNS Interface	:	Communicating with Skyline (L&T's CNS)
USB	:	USB connector
Ethernet port	:	RJ45 connector*
PCDUMP	:	Dumping of all trend data (9-pin D-type)

20. General:

Dimensions (H X W X D)	:	235 mm X 260 mm X 160 mm
Weight	:	4.86 Kg (approx) with battery and recorder, without accessories
Mounting option	:	GCX option
Operating temperature	:	5 to 40 ^{0}C
Operating humidity	:	10 to 90% RH (Non condensing)
Storage and Transportation temperature	:	-10 to 50 ^{0}C
Storage and Transportation humidity	:	0 to 90% RH (Non condensing)
Operating pressure	:	500 to 760 mmHg
Storage pressure	:	500 to 760 mmHg

* Future Upgrade

21. Accessories Supported:

ECG/Respiration	:	3 lead cable with electrodes
SpO_2	:	DS (Dura sensor) 100A (Adult) Oxy-A / N (Adult / Neonate) (Optional) Dura Y (Universal) – ear clip (Optional)
NIBP	:	Reusable blood pressure cuffs (Infant to large adult sizes)
Temperature (Optional)	:	YSI 400 series temperature probes
CO_2	:	Microstream filter lines
Remote (Optional)	:	Infrared

22. Standards:

Designed to confirm to the following international standards
Class 1 equipment requirement of IEC 60601-1
EMI/EMC requirements as per IEC 60601-1-2
IEC 60601-2-27 requirements for ECG
IEC 60601-2-30 requirements for NIBP
IEC 60601-1-8 requirements for Alarm systems
IEC 60601-2-49 requirements for multifunction patient monitor systems
ISO 9919 requirements for SpO_2
ISO 21647 requirements for CO_2
AAMI EC 13 for ECG
AAMI SP 10 for NIBP

Electro Magnetic Compatibility Information And Manufacturer's Declaration:

Electromagnetic Compatibility :

Emission Test	**Compliance level**
Radiated Emission CISPR 11	Class A, Group1
Conducted Emission CISPR 11	Class A, Group1
Harmonic Distortion IEC 61000-3-2	Class B
Voltage fluctuations / flicker emissions IEC 61000-3-3	Complies

Electromagnetic Immunity:

Immunity test	**IEC 60601 test level**	**Compliance level**
Electro Static Discharge (ESD) IEC 61000-4-2	± 6 KV Contact ± 8 KV Air	Level 3 ± 6 KV Contact ± 8 KV Air
Radiated Susceptibility IEC 61000-4-3	3 V/m Field Strength 80 MHz-2.5 GHz Frequency	3 V/m Field Strength 80 MHz-2.5 GHz Frequency
Electrical Fast Transient IEC 61000-4-4	± 2 KV for power supply lines ± 1 KV for input/output lines	Level 3 ± 2 KV Voltage
Surge IEC 61000-4-5	± 1 KV line(s) to line(s) ± 2 KV line(s) to earth	± 1 KV line(s) to line(s) ± 2 KV line(s) to earth
Voltage dips, short interruptions and Voltage variations on power supply Input lines IEC 61000-4-11	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT (>95% dip in UT) for 5 cycles	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT (>95% dip in UT) for 5 cycles
Power Frequency (50/ 60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m magnetic field strength
Conducted RF Immunity IEC 61000-4-6	3 Vrms 150 KHz to 80 MHz	3 Vrms Voltage150 KHz to 80 MHz Frequency

10

WARRANTY AND WARRANTY SERVICE

Notes:

Warranty And Warranty Service

L&T warrants its Medical equipment against only manufacturing defects for a period of 12 (Twelve) months from the date of installation or 13 (Thirteen) months from the date of despatch from L&T whichever is earlier, unless specified otherwise by separate document from L&T.

During the warranty, L&T will, at its option, either repair or replace the defective components/assemblies free of charge. The defective part shall be sent duly packed to L&T's concerned office/service station at purchaser's cost including freight, insurance and forwarding charges. Other claims, particularly for compensation, are excluded.

The warranty shall be valid only if installation and repairs are carried out by L&T's Engineer or Authorized Service Franchisee.

The warranty shall not apply to defects resulting from:

1. Unauthorized modification/misuse/mishandling of the equipment.
2. Operation of the equipment outside the environmental specifications of the product (e.g. Temperature, Electrical requirement, etc.) as specified in the operating manual.
3. Improper site preparation and maintenance.
4. Any other reason external to the equipment (e.g. accidents, vibrations, etc.)
5. Any mechanical damage to the unit and/or accessories.

Following items are specifically excluded from the warranty:

1. Battery of any type.
2. Mains Cord/Power supply cable.
3. Consumable of any type.

L&T shall not be liable for any special or consequential damages of any kind or nature. L&T will not be liable in any manner for use of or failure in the performance of other equipment to which the product is attached/connected.

EUROPE

EC REP Business Manager

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