KONTRON MEDICAL

M 7137/M 7138/M 7139

OPERATOR MANUAL

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GENERAL INFORMATION

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Manufacturer according to 93/42/CEE directive

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I. Introduction

Congratulations on becoming one of the proud customers of M 71xx ! KONTRON MEDICAL new multiparameter monitor with ECG (3/5 lead), Respiration, Temperature and upgrade options for NIBP, Pulse Oximetry and IBP. Work on CO_2 upgrade option is in progress.

M 71xx is a four channel monitor with waveform display capability for ECG (Lead I / II / III / V / AVL / AVF / AVR), Plethysmograph, Respiration, Invasive Blood Pressure (IBP1 & IBP2) and CO2. It also displays the digital values of HR, SpO2, RR, Non-Invasive Blood Pressure Readings, Invasive Blood Pressure Readings (Systolic, Diastolic and Mean) and Temperature. M 71xx has graded and colour coded patient / accessory related alarms. It has 24 hours tabular and graphical trends for all parameters except NIBP. For NIBP the last 240 readings tabular trend can be seen. Display of last 16 alarm conditions is possible in alarm recall mode. Print out of tabular trend and ECG waveform can be taken through an optional inkjet printer.

II. Safety

M 71xx is engineered for years of safe and reliable operation. To help ensure its continued performance, carefully review the information in this section.

THIS EQUIPMENT IS MEANT FOR USE BY QUALIFIED MEDICAL PERSONNEL ONLY.

EQUIPMENT FAILURE AND VENTILATION :

Failure to meet ventilation requirements may cause equipment failure and in turn 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.

KONTRON MEDICAL does not assume responsibility for damage to the equipment caused by improperly ventilated cabinets, improper or faulty power or insufficient wall strength in the case of wall mounted units.

ALARMS

Do not rely exclusively on the audible alarm systems for patient monitoring.

Adjustment of alarm volume to a low level or switching OFF alarms during patient monitoring may result in alarm conditions going unnoticed.

Remember that the most reliable method of patient monitoring combines close personal surveillance with correct operation of monitoring equipment.

PACEMAKER PATIENTS

Keep pacemaker patients under close observation. Rate meters may continue to count the pacemaker rate during cardiac arrest and some arrhythmias.

Users are informed to use :

- **NELLCOR ™* oxygen transducers along with the M 71xx unit. Using other oxygen transducers will cause the unit to display wrong readings.**

- **KM approved NIBP cuffs for blood pressure measurements. Using other accessories may result in wrong readings.**

* Nellcor is registered trademark of NELLCOR INC., California, USA.

QUALITY, RELIABILITY AND SAFETY

This equipment has been designed with an emphasis on Quality, Reliability and Safety, but KM will accept responsibility for these aspects only if the following conditions are satisfied:

1. Electrical installations of the room or building in which the equipment is to be used, comply with regulations specified by the country in which the equipment is to be used.

2. The equipment is used in accordance with the 'instructions for use' provided by KM and as specified on the rear panel of the unit.

3. All modifications and repairs are carried out by authorised KM personnel or authorised agents.

Due to continuous updating of technology, the specifications are subject to change without any prior notice.

This equipment has been designed to meet the following standards :

IEC 601-1 and corresponding national standards.

DIRECTIONS FOR DISPOSAL :

Dispose M 71xx as per national regulations & guidelines.
M 71xx contains lead acid batteries and other electrolytic capacitors.

CAUTION

Line and neutral fuses of specified rating must be used.

IF EARTHING ARRANGEMENTS ARE SUSPECTED, THE MONITOR MUST BE CONNECTED TO A MAINS LINE WITH PROPER EARTH CONNECTION TO ENSURE CORRECT READINGS.

If any function of the monitor fails, then consult KM Medical's authorised service engineer.

NOTE :

- 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.
- Possible explosion hazard if used in the presence of flammable anaesthetics.
- 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.
- Switch OFF the unit when 'low battery' indication comes on screen.
- After AC power is resumed, keep the equipment ON for 12 hours to charge battery.
- Do not use damaged cables/sensors, cuffs and contaminated accessories.

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 ON THIS UNIT ARE REMOVED FROM PATIENTS DURING SUCH PROCEDURES.

EQUIPMENT SYMBOLS & SCREEN INDICATIONS

~	Mains 230 Volts, ON indicator
	Unit ON indicator
	ON / STANDBY switch
	Equipotential ground
	Attention, refer to manual
I/O	I-Mains ON, O-Mains OFF
	Type CF isolated E.C.G. input, defibrillator proof (IEC 601-1)
	Type-B equipment (IEC 601-1)
	Alarm detection suspended
	Alarm disabled
SPO2	Oxygen Saturation in %
PR	Pulse Rate (derived from SPO2 sensor or IBP1)
HR	Heart Rate (derived from ECG)
BPM	Beats Per Minute
FAULT	Fault
CHECK HR	Displayed Heart Rate may not be valid.
	Freeze
	Zero
SYS	Systolic Blood Pressure in mmHg
DIA	Diastolic Blood Pressure in mmHg
MEAN	Mean Blood Pressure in mmHg
ARRY	Arrhythmia
PRINTING	Indicates that printing is in progress
PRINTING ERROR	Printer error
RR	Respiration Rate
CVP	Central Venous Pressure
LVP	Left Ventricular Pressure
IBP	Invasive Blood Pressure
ICP	Intracranial Pressure
PAP	Pulmonary Artery Pressure
LAP	Left Atrial Pressure
RAP	Right Atrial Pressure
ART	Arterial Blood Pressure
IPX1	Drip proof

	Indicates Valid QRS/Pulse detection
	Indicates Valid breath detection
*	Indicates detection of PR from channel

TABLE OF CONTENTS

1. DISPLAY, CONTROLS & CONNECTORS

FRONT PANEL		FUNCTION
1.	MAINS indicator	Amber colour LED turns ‘ON’ when MAINS is connected.
2.	MONITOR ON/OFF switch	To switch 'ON' or switch 'OFF' the monitor. Unit needs to be connected to the mains supply or the on internal battery.
3.	Monitor ON indicatord	Green colour LED turns 'ON' when monitor is switched ON.
4.	Alarms suspend / Alarms acknowledge key	On pressing this key all audio alarms are muted or suspended and will not sound. When Audio/Visual alarms are indicated by the unit, this key acts as alarm acknowledge key.
5.	Start/Stop NIBP measurement key	This key can be used to start/stop the inflation in NIBP cuff and begin/terminate NIBP measurement.
6.	'Zero	This key is used to zero the invasive blood pressure value.(Ensure that the IBP transducer is connected to the unit).
7.	Freeze screen key	On pressing this key, the screen waveforms are frozen.
8.	Key to return to main screen	This key enables the user to come back directly to the main screen, from any other screen.
9.	Multipurpose Optical Encoder	This is a special key which can be used for multipurpose applications. Rotating the Optical Encoder (OE) in clockwise or anti-clock direction moves the cursor (highlighted rectangular block) left or right in the MENU area of the screen. Pressing the Optical Encoder selects the particular function. The menu area consists of functions listed in the lower and right edges of the screen.
10.	Alarm indicator	Gives flashing yellow colour indication for cable/accessory related alarms like cable coming off patient and flashing red colour indication for patient related alarms e.g. when the value of any parameter being monitored goes above or below the set alarm limits.

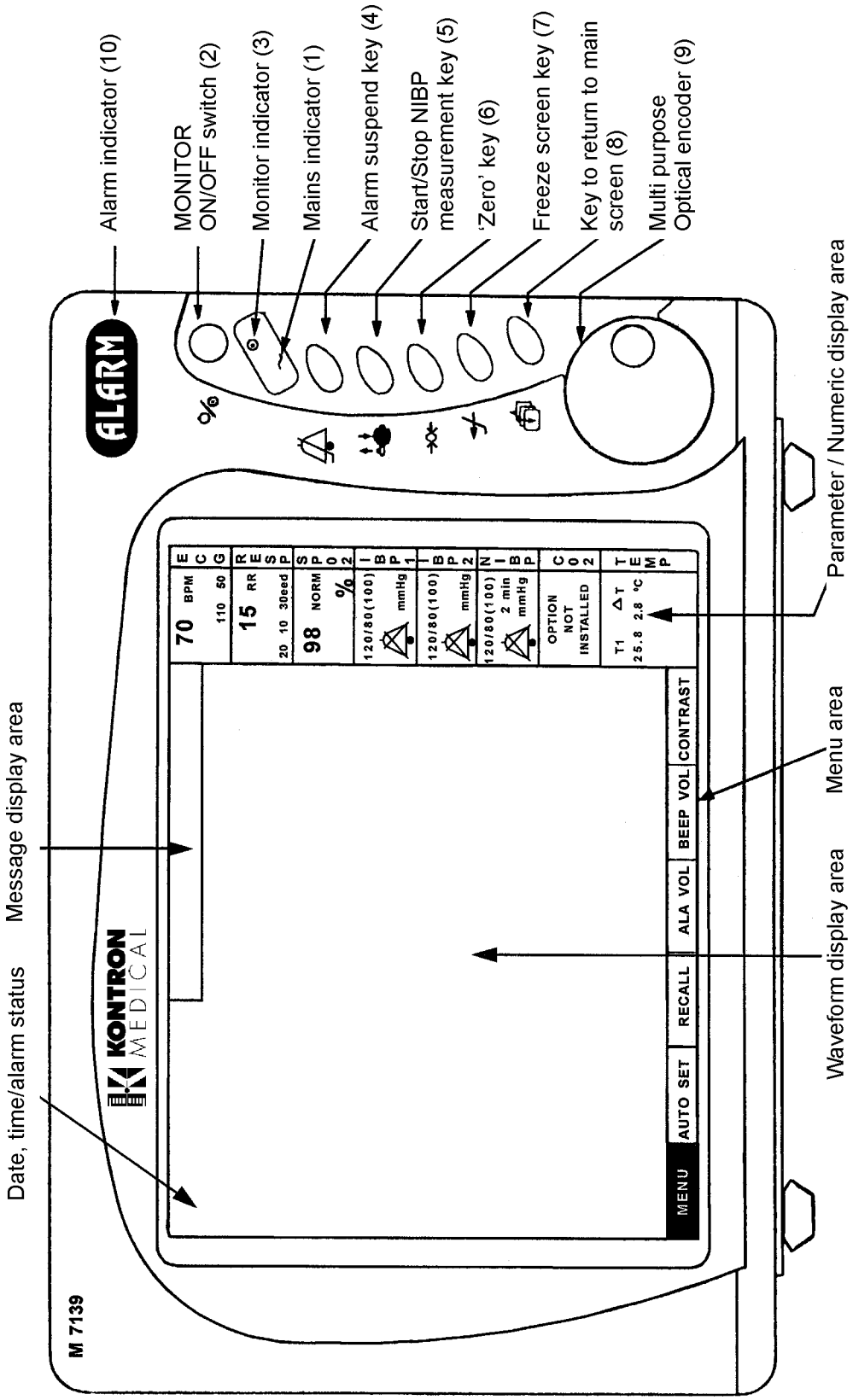


Figure 1: FRONT VIEW

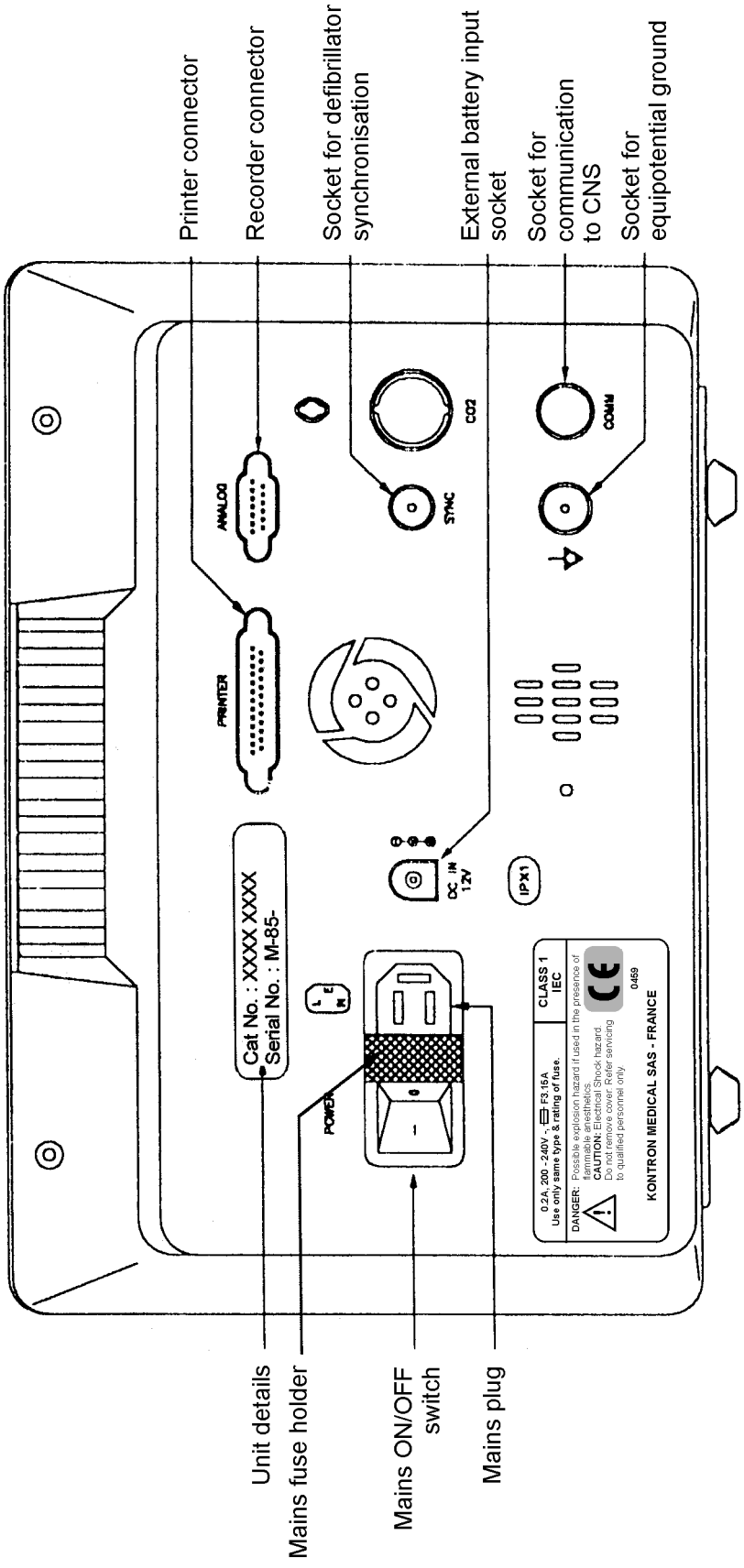


Figure 2: REAR VIEW

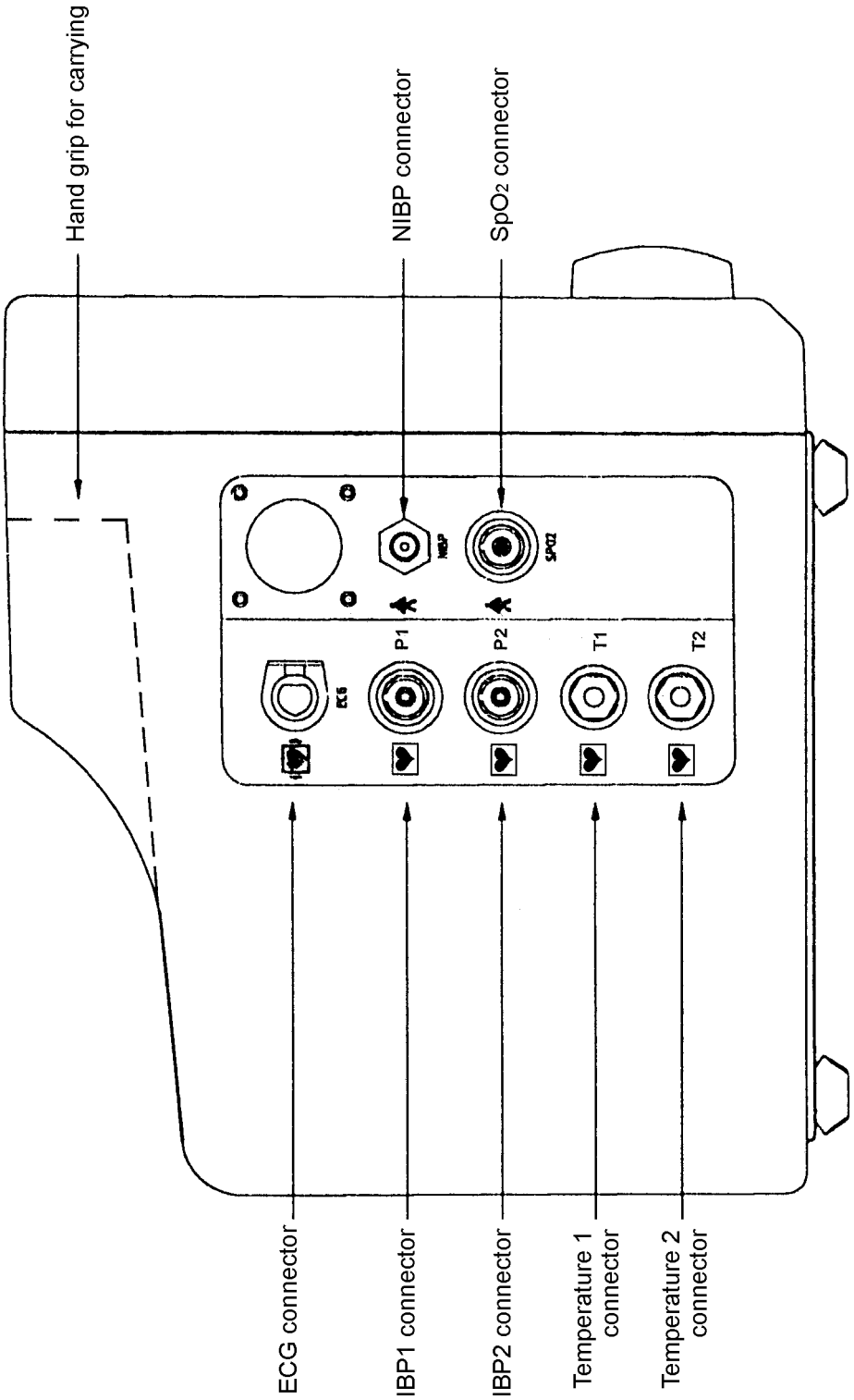
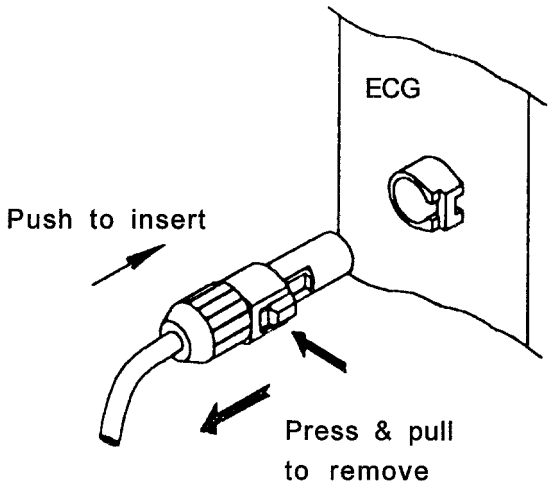


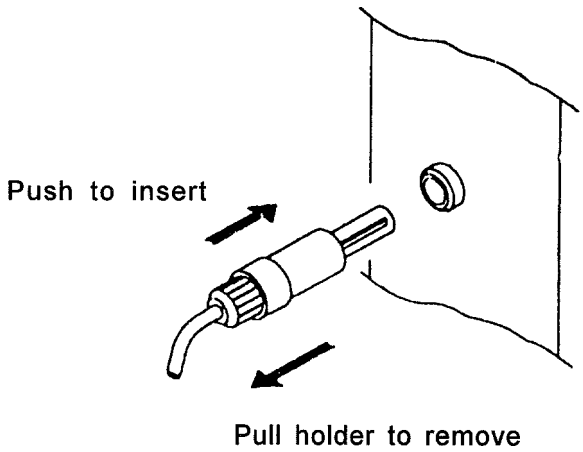
Figure 3: SIDE VIEW

1.1 How to remove the connectors ?

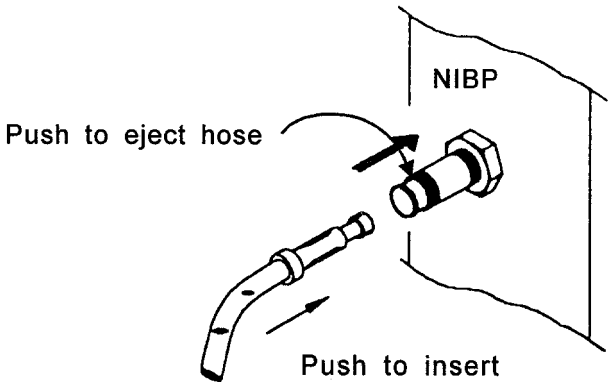
1. ECG CABLE : Press the small lever with the thumb and pull gently. [DO NOT ROTATE.]



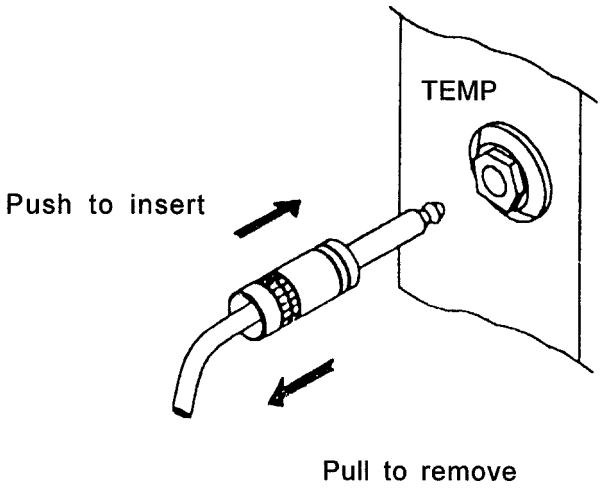
2. $Sp0_2$/IBP CABLE : Just pull gently. [Do not rotate.]



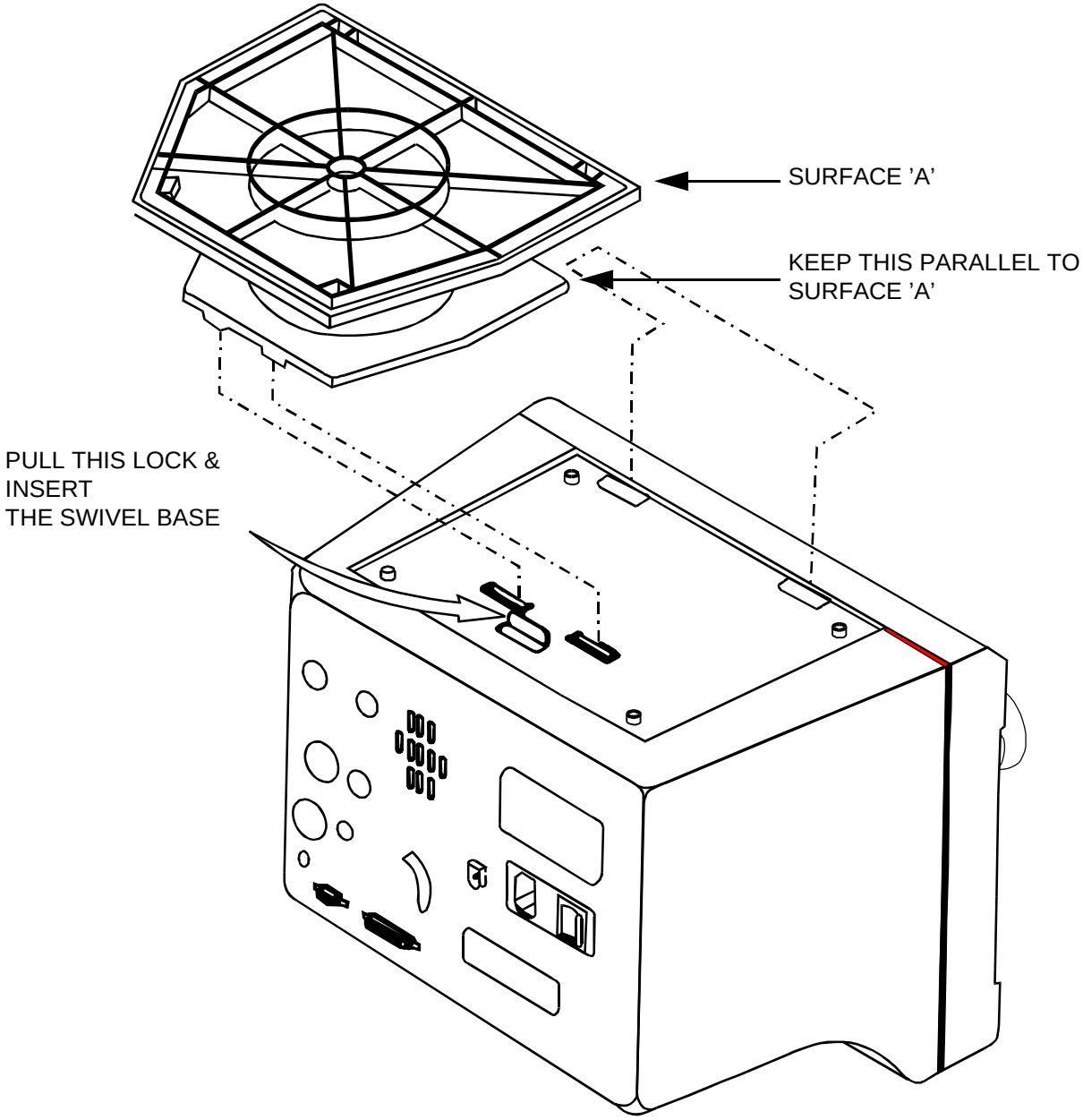
3. NIBP CABLE : Press the aluminium/iron ring of NIBP connector on unit. This will cause NIBP tubing to come out. Need not rotate.



4. TEMPERATURE CABLE : Just pull gently. Do not rotate.



1.2 How To Fix The Swivel Base ?



NOTE :

1. KEEP A SOFT CLOTH / CUSHION ON A FLAT SURFACE AND TURN THE M 71XX UPSIDE DOWN
2. UNSCREW THE EXISTING FOOT AND DISCARD THE BOTTOM COVER
3. KEEPING THE LOCK PULLED BACK, INSERT THE FRONT LIPS FIRST AND THEN PRESS THE SWIVEL BASE

2. ECG APPLICATION GUIDE

2.1 Electrode Position

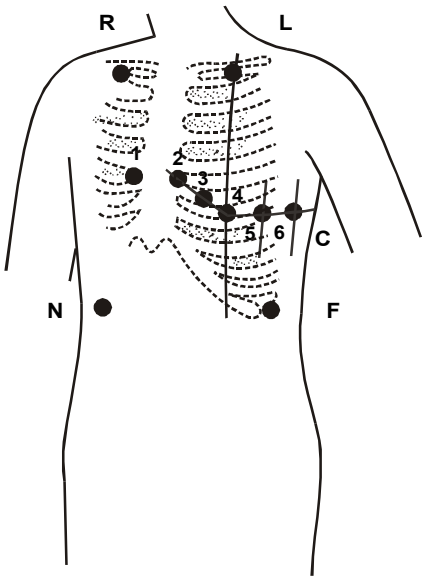
2.1.1 Introduction

For continuous, stable ECG monitoring which is not disturbed by the patient's movement, the electrodes are put on the patient's chest. The following section describes various modified ECG leads which are similar to the standard 12 ECG leads.

Position	Symbol	Lead colour (5 Lead)
Right intraclavicular fossa	R	Red
Left intraclavicular fossa	L	Yellow
Left midclavicular line about 12-15 mm above the iliac crest or the left edge of the backbone about 12-15 mm above the iliac crest.	F	Green
Right midclavicular line at the same level as F	N (RF)	Black
Any of the chest electrode positions	C	White

2.1.2 Electrode Placement (5 Lead)

Chest electrode positions:



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

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

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

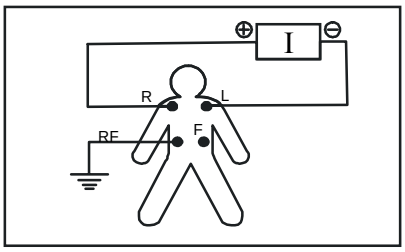
C4 (V4) : Fifth intercostal space of the left midclavicular line

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

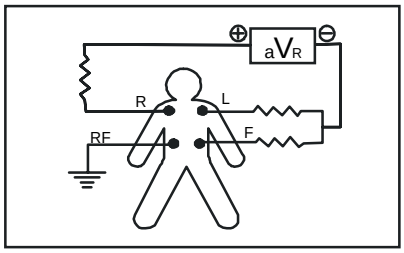
C6 (V6) : Left midaxillary at the same level as C4 (V4).

LEAD CONNECTIONS (5 LEAD)

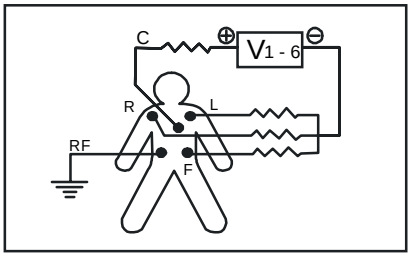
Lead I



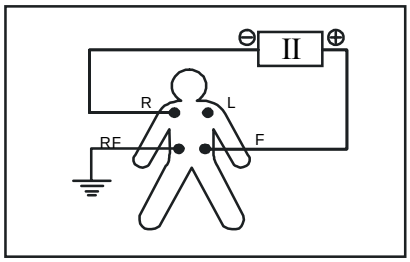
Lead II



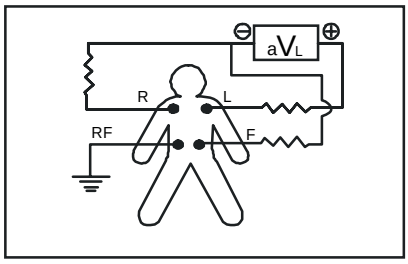
Lead V1-6



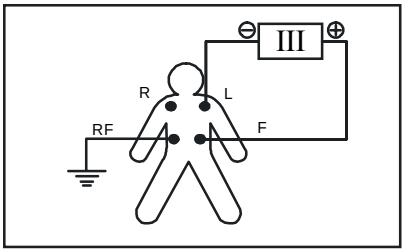
Lead II



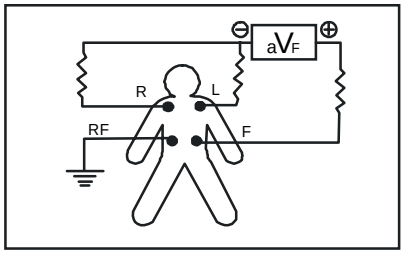
Lead aV_L



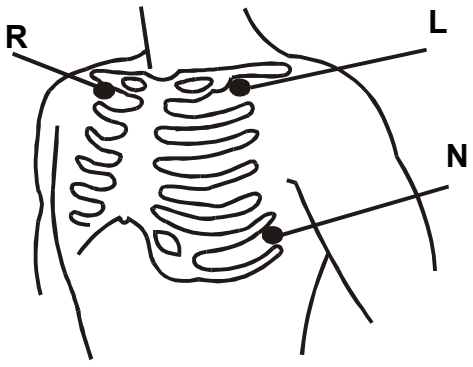
Lead III



Lead aV_F

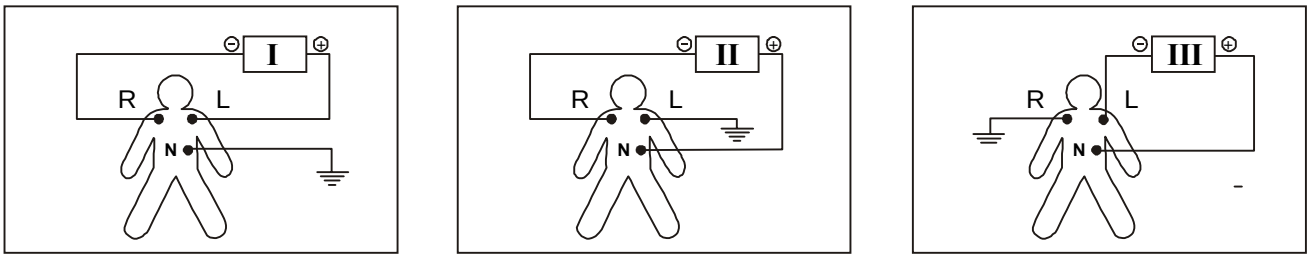


2.1.3 Electrode Placement (3 Lead):



Position	Symbol	Lead colour (3 Lead)
Right intraclavicular fossa	R	Red
Left intraclavicular fossa	L	Yellow
Between 6th and 7th intercostal space on the left midclavicular line	N	Black

LEAD CONNECTIONS (3 LEAD)



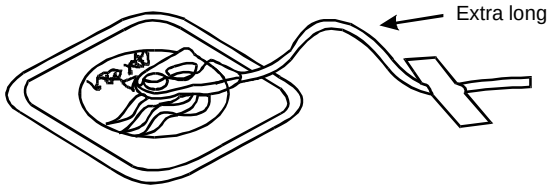
Lead I Lead II Lead III

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 cleanse site with alcohol or 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 baseline or a lead fault message.
7. Place an electrode on a flat, non-muscular 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 & 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).



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 electro-surgery, this technique can affect readings.
- Defibrillation causes temporary disruption of the waveform display.
- Burns patients may need special needle electrodes.

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 to be used. The active electrodes should be equi-distant from the proposed cutting line, but situated as far away as possible. 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, there is instantaneous recovery of the ECG trace when diathermy electrodes are removed from the patient.

Always ensure ECG cables are neatly dressed to avoid which may cause interference signals resembling cardiac waveforms, from other equip-ment.

Poor ECG trace can occur due to dry electrodes. To rectify, remove the electrodes, apply gel and re-attach with new tape. (Replace incase of disposable electordes)

This monitor meets the safety requirements for direct cardiac monitoring.

3. PULSE OXIMETRY (SpO_2) APPLICATION GUIDE

3.1 Principles Of Spo_2 Operation

The **M 71xx** provides continuous, non-invasive, automatically calibrated measurements of 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 contains two low-voltage, low intensity light-emitting diodes (LEDs) that serve as light sources and one photodiode as a light receiver. One LED emits red light (approximately 920 nm.)

When the light from the LEDs is transmitted through the blood and the various tissue components, a portion of it is absorbed . The photodiode in the sensor measures the light that is transmitted, and this measurement is used to determine how much light was absorbed.

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 M 71xx 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 lunar 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.

3.2 Automatic Calibration

Patented automatic calibration mechanisms are incorporated into the system. Each sensor is calibrated at the time of manufacture. The effective mean wavelength of the LED is determined, coded into the sensor connector in the form of a calibration resistor, and then checked. That calibration resistor is read by the software to determine the calibration coefficients which are used for the measurements obtained by the sensor.

The system is automatically calibrated each time, when it is turned on, at periodic intervals thereafter, and when a new sensor is connected. Also, the intensity of each LED in the sensor is adjusted automatically to compensate for difference in tissue thickness.

3.3 Functional Vs. Fractional Saturation

As this machine measures functional oxygen saturation, it may produce measurements that differ from those of instruments that measure fractional oxygen saturation.

Functional oxygen saturation is defined as oxygenated haemoglobin expressed as a percentage of the haemoglobin that is capable of transporting oxygen. Because M 71xx uses two wavelengths to measure saturation, it measures only oxygenated and deoxygenated (i.e. functional) haemoglobin.

In contrast, some other laboratory instruments report fractional oxygen saturation values. Fractional saturation is defined as oxygenated haemoglobin expressed as a percentage of all haemoglobin that is measured, whether or not that haemoglobin is available for oxygen transport. Measured dysfunctional haemoglobins are included in this calculation. Consequently, when measurements from the oximeter are compared with those from another instrument, it is important to determine whether that other instrument is measuring functional or fractional saturation. Those measurements can be converted to functional, using the following equation :

$$\text{Functional saturation} = \text{Fractional saturation} \times \frac{100}{100\% - [\%\text{carboxyhemoglobin} + \%\ \text{methemoglobin}]}$$

3.4 Measured Vs. Calculated Saturation

When oxygen saturation is calculated from a blood gas measurement of partial pressure of arterial oxygen (PaO2), the calculated value may differ from the oxygen saturation measurement of the oximeter. This is because an oxygen saturation value that has been calculated from blood gas PaO2 has not necessarily been correctly adjusted for the effect of variables that shift the relationship between PaO2 and oxygen saturation. These variables include temperature, pH, partial pressure of carbon dioxide (PCO2) 2, 3-DPG, and the concentration of fetal haemoglobin.

3.5 Spo_2 Sensors

WARNING : Use only KM approved sensors. Use of sensors produced by other manufacturers may result in improper oximeter performance.

WARNING : Incorrect application or use of a sensor may cause tissue damage or improper operation of the M 71xx. Carefully read the “WARNING” section of this manual and the directions for use provided with the sensor.

3.6 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.

- DS 100™ (DURASENSOR) from NELLCOR for adults above 40 Kg.
  DURA - Y™ for patients above 1 Kg. to 80 Kg.
  OXI - A/N™ for patients above 40 Kg. and below 3 Kg.
- Prepare the application site, remove nailpolish, clean surface area of contact in case 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 SpO2 and PR* (pulse rate) are displayed on the screen. * In case ECG is not connected.
- The oxygen transducer can be changed from the junction point of the patient cable if required.

NOTE:

Do not connect the oxygen transducer and non-invasive blood pressure cuffs to the same limb of the patient.

3.7 Performance Consideration

To ensure optimal performance, use an appropriate sensor, apply as described in the directions for use, keep the sensor site at the level of the patient's heart, and observe all warnings and cautions indicated in the sensor's direction for use.

If excessive ambient light is present, cover the sensor site with opaque material. Failure to do so can produce inaccurate measurements. Light sources that can affect performance include surgical lights, especially those with a xenon light source, bilirubin lamps, flourescent lights, infrared heating lamps and direct sunlight.

If patient movement is presenting a problem, evaluate the following possible solutions:

- Check whether the sensor is securely and properly attached.
- Use a new sensor with fresh adhesive backing.
- Move the sensor to a less active site.

Finally, although the M 71xx is designed to minimize any effects of electrosurgical interference, should such interference ever present a problem, evaluate the following solutions:

- Move the cables of the M 71xx and the electrocautery unit as far as possible.
- Plug the M 71xx and electrocautery unit into different AC circuits.
- Move the sensor as far away from the electrocautery site and ground pad as possible.
- Check whether the sensor is dry and firmly attached.

4. NON INVASIVE BLOOD PRESSURE APPLICATION GUIDE

4.1 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.

4.1.1 Precautions With Automatically Cycled Bp Cuffs :

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.
4. An accurate BP determination might be difficult if the patient has irregular cardiac rhythm.

CUFF SIZE SELECTION IS A VERY IMPORTANT CRITERIA TO GET ACCURATE BP READINGS.

User can select from following cuff sizes :-

DESCRIPTION	SIZE
Adult TUFF-CUFF™	14 cm x 37 cm
Child TUFF-CUFF™	9 cm x 27 cm
Neonate Pedi-sphyg™	2.5 cm x 9 cm

™ Registered Trade Marks of CAS Medical Systems, U.S.A.

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 then PR pulse rate derived from SpO_2 sensor will be displayed on the screen.

If NIBP, SpO_2 and ECG all three are connected to patient; then HR heart rate derived from ECG will be displayed on the screen.

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.

4.2 Cautions 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 widest cuff that can be placed around the upper arm should be used. For best results a cuff should be wrapped to fit snug and the limb should be positioned at heart level.
- The cuff is designed to inflate only when in place on an extremity. 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.

5. INVASIVE BLOOD PRESSURE APPLICATION GUIDE

Suitable technique and careful choice of site are important to avoid complications caused by skin infection, coagulation disorders and critical impairment of perfusion by canula.

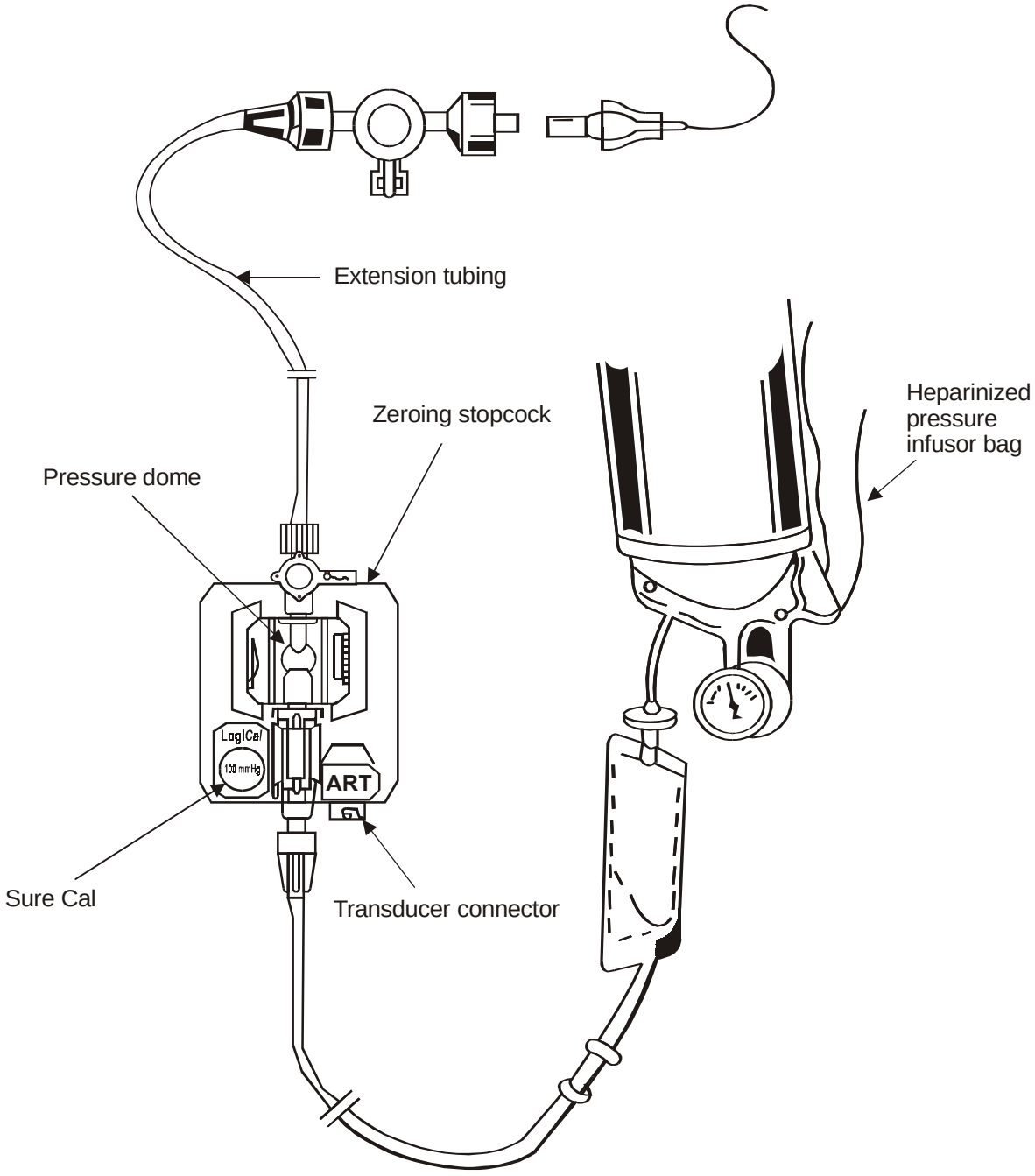
It is also important that zeroing of the equipment must be completed before each occasion of use. Calibration should be checked, whenever an uncalibrated transducer is first used, or if inaccuracies are suspected. Ideally transducer calibration should be checked once in six months.

Patient preparation :

> **Note :**
> The following actions apply to Medex make 'Logical' transducers only. (For other transducer types, refer to the manufacturers recommended assembly instruction)

1. Turn on the monitor and plug in the pressure cable, or cables in case of double pressure options.
2. It is vital that blood clots are not allowed to form in the catheter. This is achieved by continual flushing with a saline solution. The rate of flow is limited to 3 - 5 ml / hr by a flushing device, which does not alter the pressure being recorded. Prepare the pressure line and transducer by flushing saline solution through the system. Ensure that the system is free of air bubbles. (Even small bubbles will distort reading)
3. The fluid to be infused should be in a pressure bag. Inflate this to 300 mmHg.
4. Connect the patient catheter to the pressure line, making sure that no air is trapped. Clear all tubing and catheter of blood.
5. Position the transducer so that it is in line with site at which blood pressure is to be measured. Usually this is where the catheter tip is placed. (For eg., in centrally located catheters, the tip is generally considered to be in the mid-chest position. The transducer level is then set to correspond to the patient's mid-chest level)
6. Close the pressure line to the patient and open the transducer venting stopcock to atmosphere. Zero the monitor as detailed in parameter settings.
7. Check or set the CAL factor as detailed in parameter settings (only when required).
8. Select appropriate averaging time from SETUP menu. SLOW, NORMAL and FAST options are provided
9. Close the venting stopcock to atmosphere, and open the stopcock to the patient.

You are now ready to begin monitoring.


Extension tubing
Zeroing stopcock
Pressure dome
Heparinized
pressure
infusor bag
LogICal
100 mmHg
ART
Sure Cal
Transducer connector

6. TEMPERATURE APPLICATION GUIDE

Temperature has for long proved to be a useful diagnostic tool. This is especially true when differential temperatures are recorded, such as:

- Body temperature of premature baby/temperature of incubator.
- Temperature of body core / temperature of periphery (to show quality of peripheral perfusion, post cardiac surgery).
- Temperature difference between oral and rectal readings (as seen, for e.g., in suspected appendicitis)

Although temperature is an extremely 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. Extermities are always at lower temperature than the body core.
- Body temperature change throughout the day.
- Menstrual cycle. A rise of about 0.3°C takes place during ovulation.

The three zones most commonly used for measuring temperature are :

1. Rectal (typically 37° C)
2. Oral (typically 37° C)
3. Axillary (underarm) (typically 36° C)

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

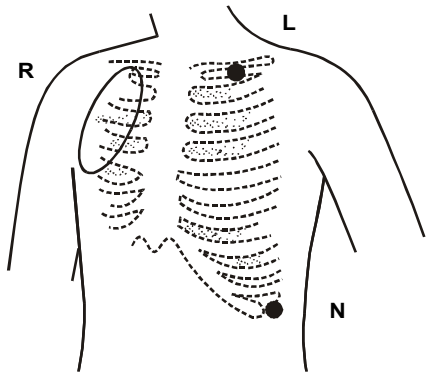
7. RESPIRATION APPLICATION GUIDE

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 M 71xx, 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 meausrement, it may be found useful to move the Right Arm electrode (R) within the area shown in the diagram.



APNOEA DETECTION

Apnoea is the cessation of breathing in infants and adults who are at risk of respiratory failure. M 7138 and M 7139 has sensitive APNOEA detection circuit which detects such an event and triggers an alarm if a user defined time limit is exceeded.

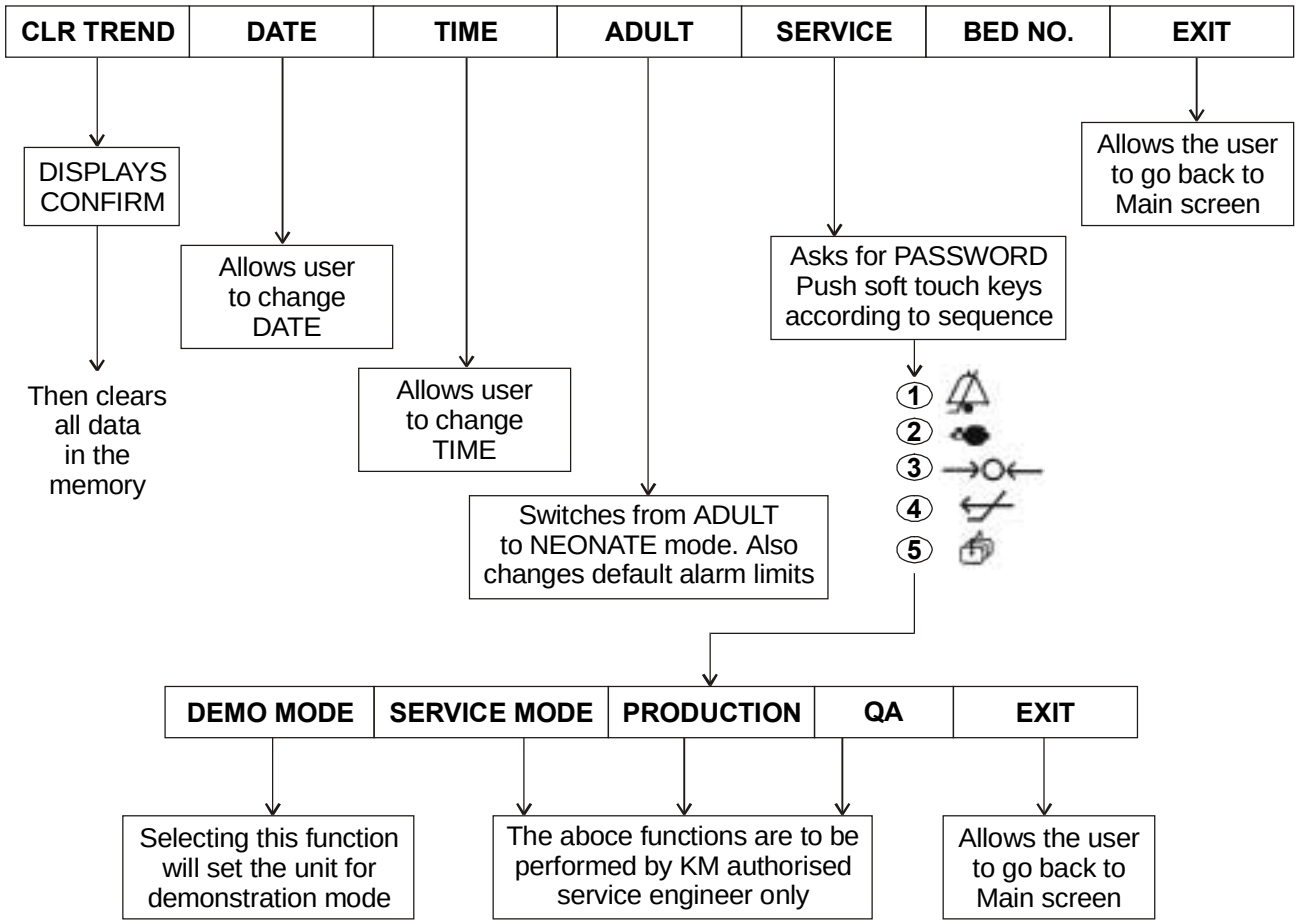
8. MAIN SCREEN AND PARAMETER SETTING

8.1 Operation

Connect the unit to a mains supply of 230 volts, 50 Hz, socket with a good ground / earthing connection.

POWER ON	Press I/O switch on the rear panel of M 71xx so that 'I' side is pressed down. Amber indicator on the front panel turns 'ON'. Press ON/STAND BY switch on the front panel so that green indicator turns on and the unit runs the self-test and displays main (home) screen. The Optical Encoder on right side can be used to move the cursor (highlighted small rectangular block) and select the desired function, along the bottom and right hand side edges of the screen.

SPECIAL FUNCTION ADJUSTMENT MENU DISPLAYED IF OPTICAL ENCODER IS PRESSED DURING SELF TEST (START-UP SEQUENCE)



* To come out of DEMO MODE, switch OFF and switch ON the unit again.

8.2 Main Screen

MENU	Allows the user to go to MONITOR SETTINGS / TREND RECALL / SYSTEM FUNCTIONS.
AUTOSET	Sets alarm limits automatically HR/PR high limit = (Present HR/PR) x 8/10 + 54 HR/PR low limit = (Present HR/PR) x 8/10 + 4 $Sp0_2$ high limit = 100 $Sp0_2$ low limit = (Present $Sp0_2$ Value - 8) or 80 whichever is greater. Systolic high limit = Present Systolic value + 10 Systolic low limit = Present Systolic value – 10 Diastolic high limit = Present Diastolic value + 10 Diastolic low limit = Present Diastolic value – 10 Respiration Respiration high limit = Present Respiration rate + 5 Respiration low limit = Present Respiration rate - 5 Temperature T1 high limit = Present T1 value + 2 T1 low limit = Present T1 value – 2
RECALL	Allows the user to recall last 16 patient related alarm conditions in tabular format.
ALA VOL	Allows the user to change the alarm volume to an appropriate level by clockwise or anti-clockwise rotation of Optical Encoder.
BEEP VOL	Allows the user to change the beep volume to an appropriate level by clockwise or anti-clockwise rotation of Optical Encoder.
CONTRAST	Allows the user to increase or decrease the contrast of the screen by clockwise or anti-clockwise rotation of the Optical Encoder. (applicable for LCD option only)

TEMP	Allows the user to enter into TEMPERATURE menu.
CO_2	Option under development
NIBPA	Allows the user to enter into NIBP menu.
IBP2	Allows the user to enter into IBP2 menu.
IBP1	Allows the user to enter into IBP1 menu.
$Sp0_2$	Allows the user to enter into $Sp0_2$ menu.
RESP	Allows the user to enter into RESPIRATION menu.
ECG	Allows the user to enter into ECG menu.

8.3 Parameter Settings : ECG

When ECG is selected the following menu will be displayed at the bottom of the screen.

LEAD	EN/DIS	LIMITS	GAIN	ARRHY	CAL	EXIT

LEAD	Allows the user to select leads I, II, III, AVL, AVR, AVF and V chest lead with 5 lead cable. Lead I, II and III only with 3 lead cable.
EN/DIS	Allows the user to enable (switch ON) or disable (switch OFF) the HR alarm detection.
LIMITS	Allows the user to set high and low alarm limits for HR. To use this function ensure that HR alarms are "ON". (enabled).
GAIN	Allows the user to choose between 0.2, 0.5, 1 and 2 mV gain for ECG waveforms. This function can be used to increase or decrease the height / amplitude of the ECG waveform.
ARRHY	On selecting this function a drop down list appears which includes TACHY, BRADY, IRREG, SK-BT and ASYSTOLE. The user can select and enable/disable required arrhythmia detection by pressing the Optical Encoder. On occurrence of arrhythmias, a message with alarm indication will appear on the screen.
CAL	After the user selects this function, square wave pulses of amplitude 1 cm/1 mV at 100 BPM are displayed on the screen continuously.
EXIT	Allows the user to go back to the main screen.

NOTE:

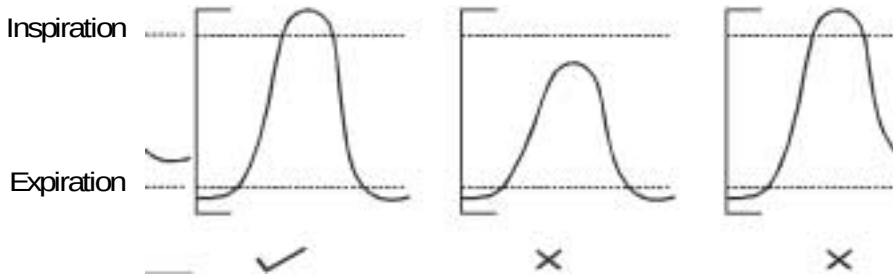
♥ Flashing heart in parameter display area indicates valid Qrs/Pulse detection.

ECG speed (12.5/25/50 mm/sec), ECG Mode (Mon/Diag.), Pacer detection (ON/OFF) options are provided in setup menu.

8.4 Parameter Settings : Respiration (If Available)

When RESP is selected the following menu will be displayed at the bottom of the screen.

EN/DIS AP	APNEA	EN/DIS RR	LIMITS	SCALE	EXIT

EN/DIS AP	Allows the user to enable (switch ON) or disable (switch OFF) Apnea detection.
APNOEA	Allows the user to set the apnoea alarm delay period in seconds. (range 5 - 90 seconds in steps of 5 seconds).
EN/DIS RR	Allows the user to enable (switch ON) or disable (switch OFF) the respiration rate alarm.
LIMITS	Allows the user to set high and low alarm limits for Respiration Rate.
SCALE	Allows the user to change the height of the respiration waveform in scales of X1, X2, X3 & X4. X1 will provide lowest amplitude and X4 will have maximum amplitude. Set the scale in such a way that the respiration waveform crosses the inspiration and expiration markers for accurate indication of respiration rate. 
EXIT	Allows the user to go back to the main screen.

NOTE:

Flashing lungs in parameter display area indicates valid breath detection.

8.5 Parameter Settings : SpO_2

When SpO_2 is selected the following menu will be displayed at the bottom of the screen.

RESPONS	EN/DIS	LIMITS	GAIN 1	EXIT

RESPONS	Allows the user to select between three response times for $Sp0_2$ readings: SLOW : preferred for neonates. NORM : preferred for adults. FAST : preferred for sleep studies.
EN/DIS	Allows the user to enable (switch ON) or disable (switch OFF) the $Sp0_2$ alarm.
LIMITS	Allows the user to set high and low alarm limits of SpO_2.
GAIN	Allows the user to increase the height of plethysmograph. Signal at pickup site : GAIN 1 for normal pulse GAIN 2 for weak pulse
EXIT	Allows the user to go back to main screen.

NOTE:

During NIBP measurement SpO_2 alarms are disabled, pleathysmograph wave form is not displayed and last valid SpO_2 readings are freezed in parameter display area. Normal SpO_2 measurement continues after NIBP measurement cycle is completed.

8.6 Parameter Settings : IBP1 (If Available)

When IBP1 is selected the following menu will be displayed at the bottom of the screen.

CAL FAC	EN/DIS	LIMITS	GAIN	LABEL	CAL	EXIT

CAL FAC	CAL FAC allows the user to caliberate the IBP transducer. 1. Press 'CAL' (machine will introduce 100mmHg CAL signal) 2. Press 'CAL FAC' and adjust display to read 100mmHg. 3. Press 'CAL' again to come out of calibration mode. **NOTE: This is not a routine procedure and needs to be carried out only in case of major discrepancies in IBP readings which might be due to ageing effect in reusable transducers.**
EN/DIS	Allows user to enable (switch ON) or disable (switch OFF) the IBP1 alarms.
LIMITS	Allows the user to set high and low alarm limits of IBP1. Press 'LIMITS'. Rotate the Optical Encoder clockwise or anti clockwise to adjust the SYSTOLIC alarm limits. Press the Optical Encoder once again to go to next limit settings. After completing SYSTOLIC & DIASTOLIC adjustments, user can come out of alarm adjustments.
GAIN	Allows the user to select between 10,20,30,60,150 & 300 gain levels to proportionately adjust waveform height on the screen.
LABEL	Allows the user to select the LABEL for pressure waveform from IBP1, ICP1, CVP1, PAP1, LAP1, RAP1, LVP1 and ART1. **NOTE: This will automatically change the gain and alarm limits.**
CAL	Allows the user to introduce a CAL pulse of 100mmHg. Press this key again to come out of this mode. This function can be used to ascertain accuracy of IBP detection circuits.
EXIT	Allows the user to go back to main screen.

8.7 Parameter Settings : IBP2 (If Available)

All the functions of IBP2 are same as IBP1.

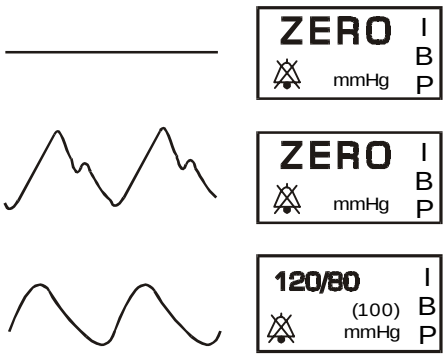
DETAILED INFORMATION

1. Check displayed information on the monitor screen.One of the following conditions will exist:

1.1. No waveforms, “ZERO" displayed. Zero the transducer. For zeroing refer step (2).

1.2. IBP WAVEFORM, “ZERO” displayed. “Zero” indicates that the transducer requires balancing. Zero the transducer. For zeroing refer step (2). **Note:** Until the transducer is zeroed no pressure readings will be displayed.

1.3. WAVEFORM, PRESSURE READINGS DISPLAYED. Pressure monitoring is in progress, the systolic, diastolic and mean pressures will be displayed.



2. Zero (balance) the pressure transducer.

To ensure accurate pressure readings the transducer must be balanced to atmospheric pressure.

Note: The transducer must be balanced whenever the “ZERO” message is displayed.

Close the pressure line to the patient. Vent the transducer to air. (atmospheric pressure)

The transducer should be placed at the level of the heart. (approximately mid axillary line)

Press the 'ZERO' key. “CONFIRM” will be displayed. Press the 'ZERO' key again. The screen will now display a stepped waveform which will level off to assume a steady zero level. Wait until '0' is displayed in parameter display area. Transducer zeroing is now complete.

Both the pressure channels (IBP1 and IBP2) can be zeroed together if the cursor is on **MENU** Individual channel can be zeroed by bringing the cursor to **IBP1** or **IBP2**.

3. Calibrate the pressure transducer. (only when required).

All transducers must be calibrated before use to ensure accurate pressure readings.

To calibrate the transducer, a known pressure signal of 100 mmHg is applied. If the reading on screen shows an offset, it is corrected using electronic adjustment routines.

Proceed as follows:

Close the pressure line to the patient. Vent the transducer to air. Ensure that the transducer is zeroed, then select the IBP option from the main screen using Optical Encoder and press the CAL key.

Adjust the displayed reading to match that of the definite level of 100 mmHg by selecting 'CAL FAC' and rotating Optical Encoder clockwise or anti-clockwise.

After adjustment come out of 'CAL FAC' by pressing Optical Encoder once. To come out of CALIBRATION mode press 'CAL' again, then close the transducer to air.

4. Open pressure line to the patient.

Complete pressure line connections and adjustments. Then open the pressure line between the patient and the transducer. The screen will now display the patient pressure waveform and the systolic, diastolic and mean readings.

5. Select appropriate waveform label :

To help identify the source/type of pressure being monitored each waveform can be allocated with a label.

The table below identifies the labels available

Label:

BP	Invasive Blood Pressure Channel
CP	Intracranial Pressure
CVP	Central Venous Pressure
PAP	Pulmonary Artery Pressure
LAP	Left Atrial Pressure
RAP	Right Atrial Pressure
LVP	Left Ventricular Pressure
ART	Arterial Blood Pressure

To change label, select the IBP option from the main screen using Optical Encoder key and choose LABEL.

Rotate the encoder either clockwise or anti-clockwise and press it to select the desired label.

Change of IBP labels will change the gain and default alarm limits for systolic/diastolic pressure.

6. Adjust pressure range/waveform size:

The pressure waveform size can be adjusted by selecting a different pressure gain/scale.You can adjust waveform size by selecting the pressure gain by pressing the GAIN option in IBP menu.

GAINS AVAILABLE – 300, 150, 60, 30, 20, 10 mmHg for both ADULT & NEONATE.

There are two modes of measuring IBP.

ADULT mode.

NEONATE mode.

The user can select this by pressing the Optical Encoder during self-test (start-up sequence).

SPECIAL FEATURE

- Size of systolic / diastolic readings doubles if alarms are disabled.
- If CVP label is selected for IBP2, mean reading is displayed in bigger font.
- An appropriate averaging time can be selected from SETUP menu. SLOW, NORMAL and FAST options are provided.

8.8 Parameter Setting : NIBP

When NIBP is selected the following menu will be displayed at the bottom of the screen.

STAT	EN/DIS	LIMITS	AU/MA	TIMER	CAL	EXIT

STAT	STAT MODE. Allows the user to set the machine to take as many readings of NIBP as possible in 5 minutes of continuous operation.
EN/DIS	Allows the user to enable (switch ON) or disable (switch OFF) the NIBP alarm.
LIMITS	Allows the user to set high and low alarm limits for NIBP.
AU/MA	Stands for AUTOMATIC OR MANUAL. AUTOMATIC : For taking BP readings automatically after set intervals. Press START on the front panel to take the first reading. MANUAL : For taking 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.
TIMER	Becomes operational after selecting 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.
CAL	The CAL function is not provided in NIBP.
EXIT	Allows the user to go back to main screen.

NOTE:

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

During NIBP measurement SpO_2 alarms are disabled, pleathysmograph wave form is not displayed and last valid SpO_2 readings are freezed in parameter display area. Normal SpO_2 measurement continues after NIBP measurement cycle is completed

8.9 Parameter Settings : Temperature

When TEMP is selected the following menu will be displayed at the bottom of the screen.

EN/DIS T1	LIMITS	UNIT	CAL	EXIT

EN/DIS T1	Allows the user to enable (switch ON) or disable (switch OFF) TEMP alarm.
LIMITS	Allows the user to set high and low alarm limits for TEMPERATURE.
UNIT	Allows the user to select the unit for TEMP. (Centigrade or Fahrenheit).
CAL	When it is selected, 37°C will be displayed at T1.
EXIT	Allows the user to go back to main screen.

NOTE:
T2 will be displayed alongwith T1 if difference between T1 and T2 is greater than 9°C (50°F), otherwise difference (∆T) will be displayed alongwith T1.

USE ONLY THE RECOMMENDED SENSORS.

Detailed information:

1. Check displayed information:

1.1. When both the temperature connectors are absent, OFF will be displayed under T1 and ∆T.

1.2. When we insert both connectors into the TEMP sockets, one of the following will be displayed:

a. Normal display

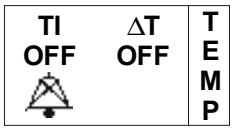
Two temperature inputs connected, T1 shows core temperature, ∆T shows the temperature difference (T1-T2).

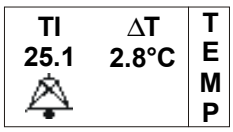
b. Normal display

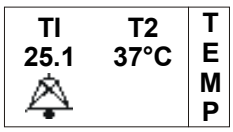
As above except T2 will show actual site temperature (site temperature T2 is displayed if the difference in temperatures is greater than 9°C).

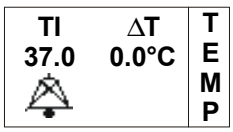
c. CAL display

After selecting CAL option from the menu list of TEMP, T1 will show 37.0°C.









2. Adjustment of alarm limits:

To set alarm limits, select the TEMP. option from the main screen and press the LIMITS.

Rotate the Optical Encoder either clockwise or anti-clockwise and then press it for selecting the limits for T1.

You can also enable (switch ON) or disable (switch OFF) the alarm limits in the monitor by selecting the 'EN/DIS T1' option.

3. Selection of temperature unit:

Select the 'UNIT' option from the drop down list and you can select either CENTIGRADE OR FAHRENHEIT as a temperature unit.

9. MONITOR SETTINGS, TREND RECALL AND SYSTEM FUNCTIONS

MENU : Allows the user to enter into Monitor settings / Trend / System related functions.

TREND	DISPLAY	PAT INFO	SETUP	SYSTEM	OUTPUT	EXIT

TREND : On selecting this function a drop down list appears which includes MODE, NIBP, PARAMETER, VIEW, EXIT.

MODE

GRAPHICAL : Graphical representation of trend for selected parameters at intervals of ± 6 hour and ± 1 hour format (not applicable for NIBP).

TABULAR : Tabular representation for selected parameters

Last 240 readings NIBP trend is indicated in a tabular format.

EXIT : Allows the user to go back to previous screen.

NIBP : Tabular representation of last 240 stored NIBP readings.

↑ : Allows the user to go to the next page of the trend.

↓ : Allows the user to go to the previous page of the trend.

PRINT : Allows the user to print the current page of the trend.

EXIT : Allows the user to go back to the previous screen.

PARAMETER : Allows the user to select any three parameters from HEART RATE, RESP RATE, SPO2, TEMP1, TEMP2, IBP1 and IBP2 for graphical or tabular trend display.

VIEW (GRAPHICAL MODE)

SCALE : Allows the user to view trend in ± 6 hour or ± 1 hour format.

MARK : Allows the user to select an area on the graphical trend for printout. Pressing this key once will show a dotted line on the trend. Rotate the Optical Encoder to select a starting point of "Mark Area". Press to confirm. Rotate the Optical Encoder again to select the end point of "Mark Area".

PRINT : Allows the user to print the marked area in tabular form.

EXIT : Allows the user to go back to the previous screen.

VIEW (TABULAR MODE)

↑ : Allows the user to go to the next page of the trend.

↓ : Allows the user to go to the previous page of the trend.

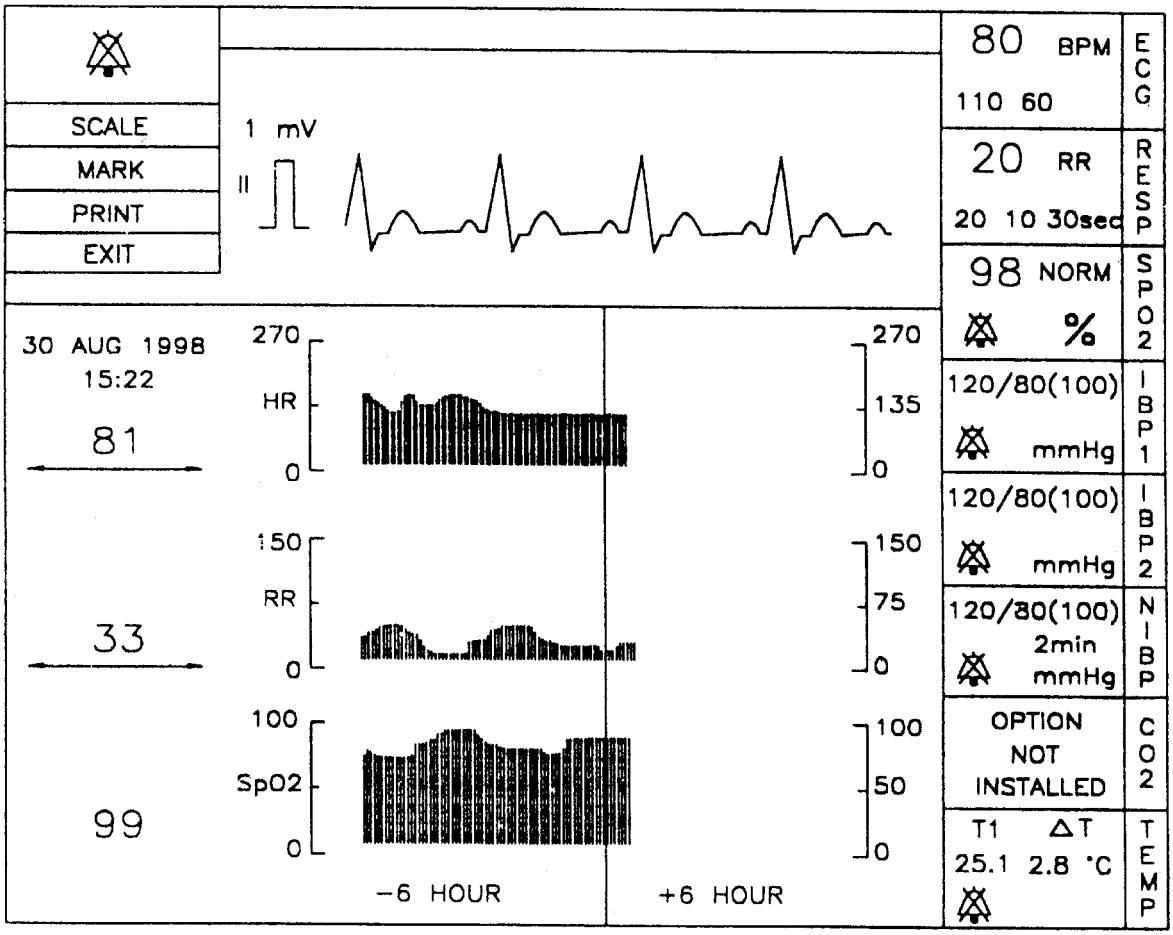
PRINT : Allows the user to print the current page of the trend.

EXIT : Allows the user to go back to the previous screen.

EXIT : Allows the user to back to the main screen.

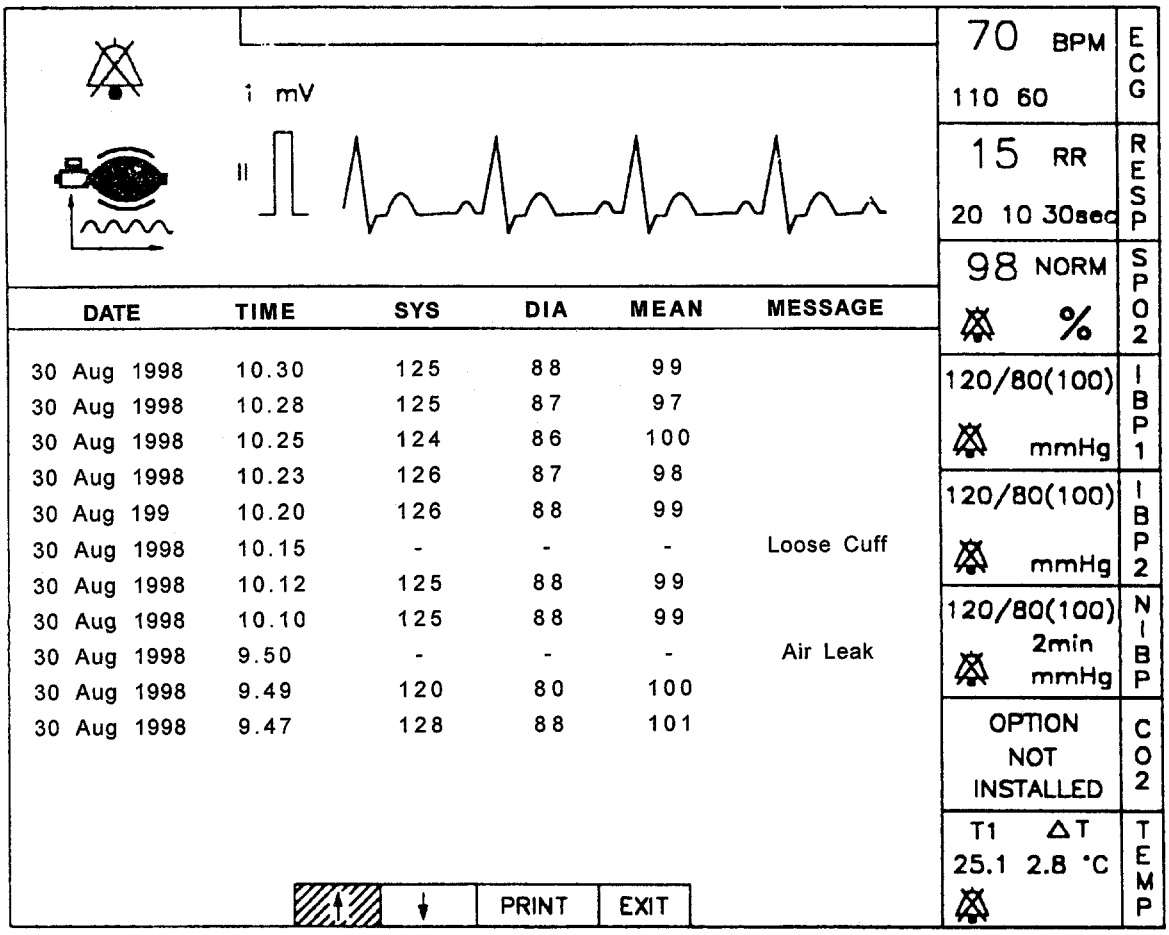
GRAPHICAL TREND SCREEN

SELECT → MENU → TREND → MODE → GRAPHICAL → VIEW



TABULAR TREND SCREEN FOR NIBP

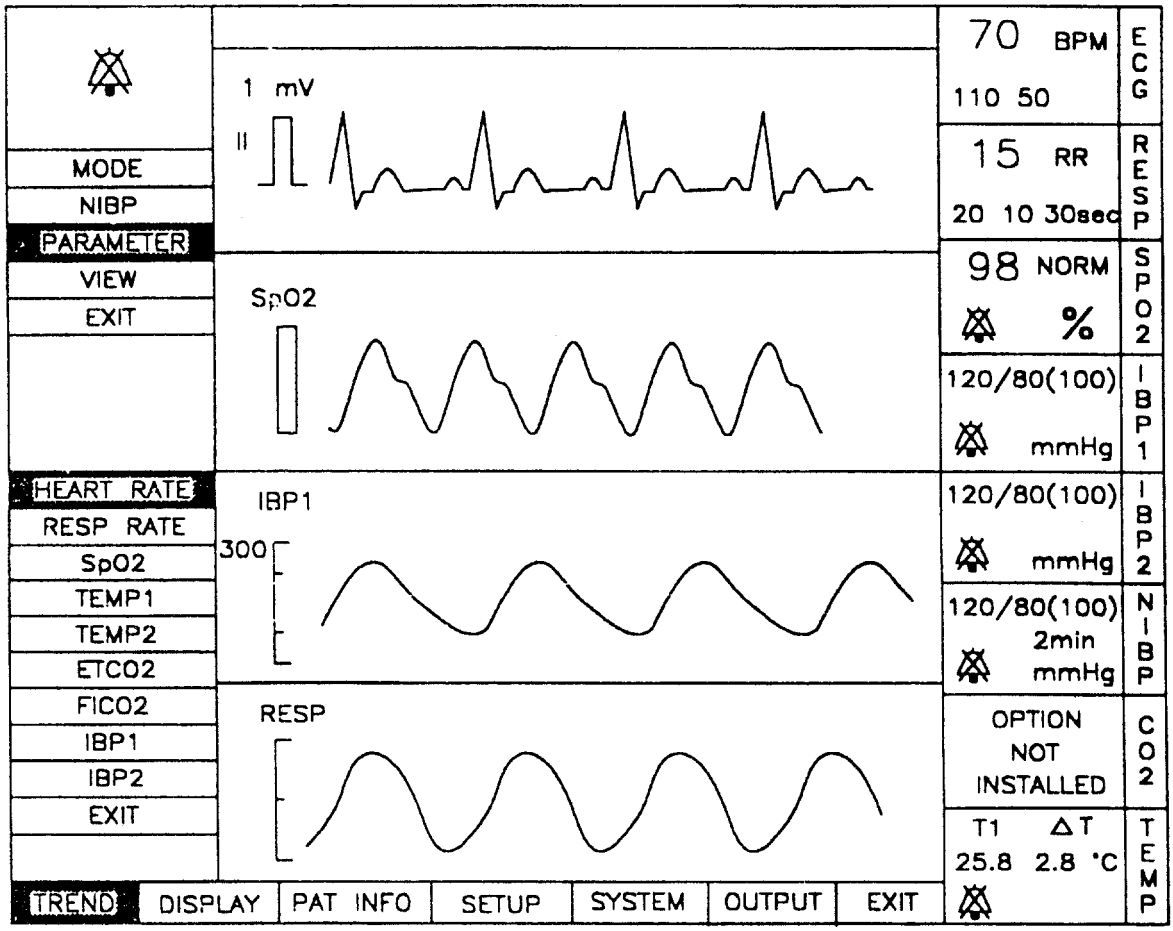
SELECT → MENU → TREND → NIBP



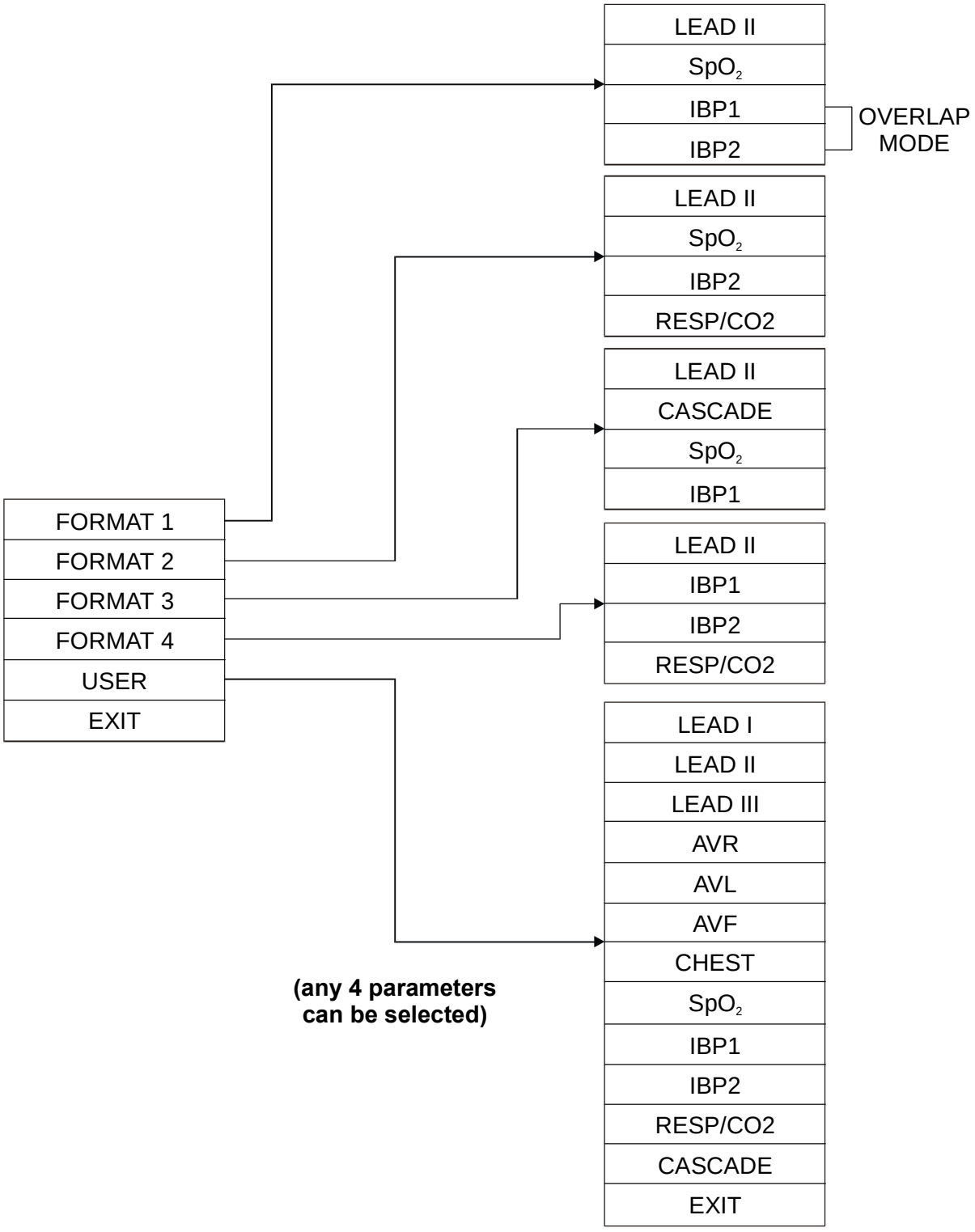
DATE	TIME	SYS	DIA	MEAN	MESSAGE
30 Aug 1998	10.30	125	88	99	
30 Aug 1998	10.28	125	87	97	
30 Aug 1998	10.25	124	86	100	
30 Aug 1998	10.23	126	87	98	
30 Aug 199	10.20	126	88	99	
30 Aug 1998	10.15	-	-	-	Loose Cuff
30 Aug 1998	10.12	125	88	99	
30 Aug 1998	10.10	125	88	99	
30 Aug 1998	9.50	-	-	-	Air Leak
30 Aug 1998	9.49	120	80	100	
30 Aug 1998	9.47	128	88	101	

TREND PARAMETER

SELECT → MENU → TREND → PARAMETER

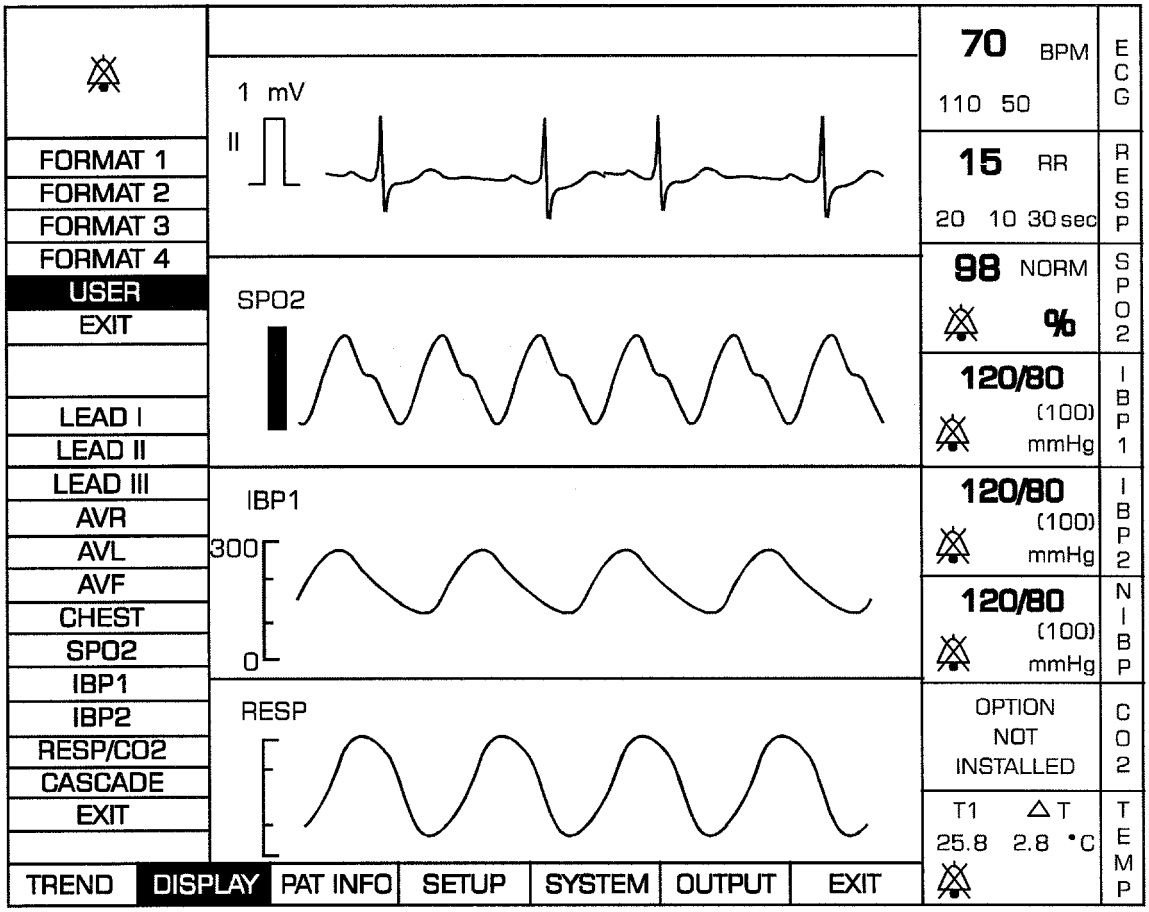


DISPLAY : Allows the user to configure the display of M 71xx.
It has four factory set display formats and one user selectable.
eg. In FORMAT 1 it shows LEAD II, SpO_2, IBP1, IBP2.



DISPLAY PARAMETER SCREEN

SELECT → MENU → DISPLAY → USER



PAT INFO : Allows the user to enter patient information as listed below.

BED NO. : Allows the user to enter Bed number of patient.

NAME : Allows the user to enter name of patient. (upto 11 characters.)

AGE : Allows the user to enter age of patient. in years for adults and days for neonates.

SEX : Allows the user to enter sex of patient. i.e. Male/Female.

WEIGHT : Allows the user to enter weight of patient in KGS.

I.D. NO. : Allows the user to enter an identity number for the patient.

CLEAR ALL : Allows the user to erase all recorded trend data and patient information.

EXIT : Allows the user to go back to main screen.

SET UP : Allows the user to change the system settings as listed below.

REV VIDEO : On selecting this option the screen changes from black background to white background for LCD display and black background to yellow background for EL display.

ECG MODE : On selecting this option it lists 2 modes which are MON (Monitoring - ECG bandwidth 0.5 Hz to 100 Hz) and DIAG (Diagnotic - 0.05 Hz to 100 Hz).

ECG SPEED : On selecting this option a drop down list appears which includes 12.5mm/sec, 25mm/sec, 50mm/sec. The user can select any one of these for the trace speed of ECG/IBP/SpO_2 waveform.

RESP SPEED : On selecting this option a drop down list appears which includes 6.25mm/sec, 12.5mm/sec, 25mm/sec. The user can select any one of these for trace speed of respiration wave form.

PACER DET : On selecting this a drop down list will appear which includes two options for the Pacer detection to be ON/OFF.

IBP AVG : On selecting this a drop down list will appear which includes SLOW (8 beats), NORM (6 beats), FAST (4 beats) averaging for Invasive Blood Pressure readings.

DEFAULT : On selecting this option, the monitor sets to the DEFAULT or factory settings for alarm limits and other display settings.

EXIT : Allows the user to go back to the main screen.

SYSTEM : Allows the user to view all information or alarm information when MENU -->SYSTEM is selected.

ALL INFO : Allows the user to get information about all the settings on monitor screen.

ALARM INFO : Allows the user to get information about the status, limits (High & Low) and units of all the alarms.

NO CHANGES IN THE INFORMATION DISPLAYED CAN BE MADE HERE

EXIT : Allows the user to go back to the main screen.

OUTPUT : Allows the user to set the recording related setting.

WFPRN : Allows the user to print ECG waveform on recommended inkjet printer if recorder is off.

REC OFF : Allows the user to start/stop external analog recorder if printing is not enabled.

SETUP : On choosing this function the user can select between direct and delayed recording.

Direct : Starts recording the moment this function is enabled.

Delayed : Records ECG waveform 10 seconds before and 30 seconds after the function is enabled. (this is typically for a 40 second duration selection)

DURATION : Selection of interval from 10, 20 & 40 seconds for delayed recording.

EXIT : Allows the user to go back to the previous screen.

EXIT : Allows the user to go back to the main screen.

SYSTEM INFO SCREEN

SELECT → MENU → SYSTEM → ALL INFO

ECG	SpO_2	IBP1	DISPLAY	ALARM VOLUME
MODE : ADULT GAIN : 1.0 mV SPEED : 25 mm/s LEAD : LEAD II FILT : DIAG CONFIG : 3 LEAD VER : 1.07	RESPONSE : NORM GAIN : GAIN1	RANGE: 300 mmHg LABEL : IBP1 CAL FACTOR : 100 mmHg FOR 100 mmHg	LEAD II SpO_2 IBP2 RESP OUTPUT WF PRN	
ARRHYTHMIA	CO2	IBP2		BEEP VOLUME
TACHYCARDIA BRADYCARDIA IRREGULAR SKIP BEAT ASYSTOLE	MODULE NOT CONNECTED	RANGE: 300 mmHg LABEL : IBP2 CAL FACTOR : 100 mmHg FOR 100 MMHg	TREND FIRST DATA DATE : 2 SEP 1998 TIME : 12:58	
SYSTEM	TEMPERATURE	NIBP		CONTRAST
VERSION : 1.17 RESPIRATION SPEED : 25 mm/sec APNEA : 30 sec	UNIT : CENTIGRADE	MODE : AUTO DURATION : 2 min	GRAPHICAL PARAMETERS : 1. HR 2. RR 3. SpO_2	
	PRESS ENTER KEY TO CONTINUE			

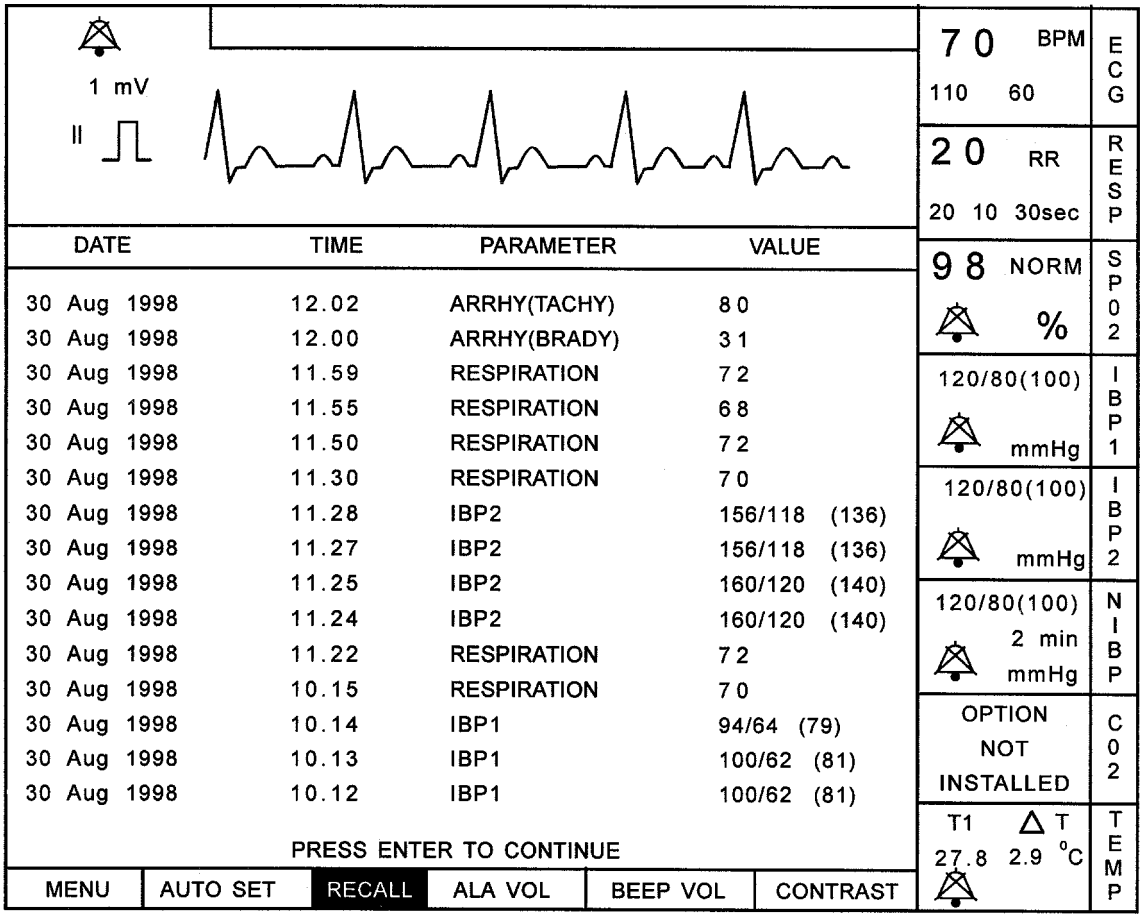
ALARM INFO SCREEN

SELECT → MENU → SYSTEM → ALARM INFO

PARAMETER	HIGH LIMIT	LOW LIMIT	STATUS	UNIT
HEART RATE	120	70	ENABLED	BPM
SpO_2	100	95	DISABLE	%
IBP1 SYS	160	100	ENABLED	mmHg
IBP1 DIA	100	75	ENABLED	mmHg
IBP2 SYS	160	100	ENABLED	mmHg
IBP2 DIA	100	75	ENABLED	mmHg
NIBP SYS	180	80	DISABLE	mmHg
NIBP DIA	100	75	ENABLED	mmHg
ETCO2	60	13	DISABLE	mmHg
FICO2	5	OFF	DISABLE	mmHg
TEMPERATURE	25.5	0.5	DISABLE	°C
RESP RATE	60	10	ENABLED	RR
APNEA	10		ENABLED	SEC
PRESS ENTER KEY TO CONTINUE				

ALARM RECALL SCREEN

SELECT - RECALL (FROM MAIN SCREEN)



10. MAINTENANCE SCHEDULE

10.1 ROUTINE MAINTENANCE

KM products have been designed to operate continuously for long periods without maintenance.

However, in order to ensure a continued high level of performance and safety of operation, the routine maintenance information in this section MUST be observed. A summarised schedule and full details of this level is contained in this section.

Caution:

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

START UP – Daily or every time used.

To be carried out on site by operator.

NOTE:

Where a dot appears, action is required. The action details appear after the schedule and are numbered by line and column.

ACTION	GENERAL	ECG, RESP, IBP1, IBP2, SPO2, TEMP, NIBP
	A	B
1. Check patient connections 1 accessories		*
2. Cleaning & sterilisation of patient connected accessories		*
3. Clean monitor exterior	*	
4. Check power cord	*	
5. Check battery	*	
6. Check monitor operation	*	*
7. Check monitor calibration		*

10.2 Action Details

1B) Leads, sensor and probes should be carefully checked for any signs of damage to sensors, leads insulation or terminations. Damaged leads should be replaced, not repaired. DO NOT ATTEMPT REPAIR.

Pressure domes and transducers should be carefully checked for any signs of damage. Special care should be taken to check the dome for cracks, and the transducer for a damaged diaphragm. Damaged items should be replaced.

2B) All patient connected accessories must be cleaned before use. The following instructions details the methods to be used for each type of accessory. Several precautions must be observed while cleaning and sterilising these accessories as they are easily destroyed with improper handling.

Caution:
NEVER BOIL OR AUTOCLAVE THE VINYL JACKETED LEAD WIRE.

The vinyl may be safely exposed to temperatures upto 100°C, but above 90°C the vinyl softens and can be deformed permanently by mechanical stress. Handle gently when hot.

DO NOT USE PHENOL BASED CLEANERS

NEVER IMMERSE CABLES IN ANY LIQUID

Avoid contact with strong, aromatic, chlorinated, ketone, ether or ester solvents. Prolonged immersion in alcohol or mild organic solvents, detergent solutions or highly alkaline solvents will cause the vinyl to lose its flexibility.

During cleaning or sterilization, sensors should be handled gently. When wiping clean, hold the sensor in one hand at the tip and wipe the sensor and lead wire towards the plug end. If excessive pressure is used, the covering will be stretched, which may break the internal wires and destroy the probe.

Continued flexing of lead wires in use and during cleaning will break the internal wires and cause failure. Failure from this cause is not covered by manufacturer's warranty.

10.3 Cleaning

DO NOT USE A SHARP INSTRUMENT

1. ECG leads and sensors should be cleaned with a cloth lightly moistened with soap water or alcohol. Always allow the cable to dry thoroughly before use.
2. Pressure domes and transducers should be cleaned to remove any foreign material from the membrane surface.
3. Clean blood from all external surfaces.
4. Carefully clean transducer with a cotton swab using a blood solvent. Avoid any pressure on the diaphragm.
5. Clean the transducer lead with a cloth lightly moistened with soap water or alcohol. Always allow cable to dry thoroughly before use.

> **NOTE:**
> The clear polycarbonate dome may discolour and have reduced life expectancy after many sterilization.

6. Temperature sensors should always be cleaned as follows:
   Sensors may be disinfected and sanitized by washing with 3% hydrogen peroxide or 70% isopropanol. 70% ethanol is nearly as effective, but 100% alcohol is less germicidal. Brief immersion in detergent solutions is not harmful. Phenol disinfectants, such as hexachlorophene should be avoided because the disinfectant may be absorbed by the vinyl.

   NEVER BOIL OR AUTOCLAVE ANY YSI SERIES 400 TEMPERATURE SENSOR

   Autoclaving may cause the insulation to fail and may also cause the sensor to give inaccurate temperature readings.

   Ethylene oxide sterilization does not damage the sensor but the gas is highly irritating and is absorbed by the plastic parts. Directions given by the manufacturer of the sterilizer must be followed, and before handling or use, sensors must be safely and thoroughly ventilated according to the sterilizing apparatus and manufacturer's instructions. Biological indicators should be employed to ensure that sterility has been achieved.
7. Cuff and hoses" should be cleaned as follows:

   7.1. Cuffs – reusable cuffs may be cleaned in any of the two ways
      1. Sponge the outside of the cuff with a damp cloth.
      2. Remove the cuff's bladder. Wash the cuff in water with soap or detergent / disinfectant. Rinse the cuff and allow it to air dry.

   7.2. Hoses – clean the double hose by wiping it with a cloth moistened with alcohol.

DO NOT IMMERSE THE HOSE IN ANY LIQUID

DO NOT USE PHENOL-BASED CLEANER

10.4 Sterilization

DO NOT STEAM AUTOCLAVE, USE ETHYLENE OXIDE GAS ONLY

1. Clean as detailed above.
2. Wrap the connector lead in a polythene bag to prevent moisture penetration.
3. Loosely coil the cable to avoid any kinks, as this would restrict the venting of the transducer.
4. Wrap transducer and cable in the recommended way for ethlene oxide sterilization.
5. Using the recommended procedure, sterilize and degas before use.
6. The sterilizer temperature must not exceed 70° C (158° F); plastics in the pressure transducer may deform or melt above this temperature.

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 to dry thoroughly before use. DO NOT USE CHEMICALS OR ABRASIVE CLEANING AGENTS.

4A) Inspect the power cord for any signs of damage to cable or connectors. If damaged, replace with a genuine KM replacement part. DO NOT ATTEMPT REPAIR.

5A) Isolate monitor from the mains supply. Switch MONITOR ON, and observe the green LED. If green LED is ON, the battery status is acceptable and no further action is required.

If the green LED is flashing with LOW BATT indication, connect monitor to mains supply and switch on the rear panel mains power switch. Leave the unit on charge until the next START UP battery status check. If still unsuccessful, refer the monitor to service personnel for battery replacement.

> **Caution:**
> BATTERIES WILL BE PERMANENTLY DAMAGED IF LEFT DISCHARGED.

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

- Adjustment of LCD contrast (for LCD machine only.)
- Adjustment of alarm volume.
- Adjustment of QRS volume.
- Adjustment of alarm limits. Enabling & disabling of individual alarms.
- Operation of alarm functions.
- Operation of record functions (optional).
- Operation of fault function (patient cable disconnected).
- Selection of trace speed for ECG, RESP, IBP, SpO_2.

- Selection of waveform parameters.
- Selection of graphical/tabular trend view.
- Selection of ECG, SpO_2, IBP, RESP gains.
- Selection of ECG arrhythmias.
- Selection of SpO_2 response.
- Selection of IBP label.
- Selection of Apnoea detect duration.
- Selection of TEMP unit (either ºC or ºF).
- Selection of NIBP mode.

Return all adjustments to the desired settings after the checks.

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

» *ECG*

- Select CAL option from the menu list of ECG and observe the display.
- Square pulses will be produced of 1mV/1cm amplitude.
- 100 BPM will be displayed in HR area.

> **NOTE:**
> CAL is associated only for Lead II.

» *PRESSURE (IBP1 & IBP2)*

- Select CAL option from the menu list of IBP and observe the display.
- The IBP readings will increase by 100mmHg.

> **NOTE:**
> IBP gain should be >=100 when CAL is selected.

» *TEMPERATURE*

- Select CAL option from the menu list of TEMP and observe the display.
- T1 will read 37.0°C.
- ΔT will read 0.0°C.

11. TROUBLE SHOOTING GUIDE

11.1 Trouble Shooting Chart

PROBLEMS	CAUSE	CORRECTIVE ACTION
No display	Mains not available.	Mains I/O switch not ON. Press 'I' to switch ON.
	Fuses blown.	Call KM authorised service engineer for repairs.
No audible alarm indication	'Alarm Off' mode selected.	Enable alarm.
Low battery indication on screen	Battery level going down. Unit will stop operating in few minutes.	Connect the unit to mains and allow the battery to charge.
Cable not connected message on screen.	ECG cable not connected.	ECG cable has to be connected to the patient and machine.
No QRS tone.	QRS volume set to minimum.	Adjust QRS volume by using optical encoder.
Poor ECG waveform.	Electrode sites are incorrect.	Resite electrodes.
	Poor electrode contact.	Resite electrodes.
	Dried electrodes.	Remove electrodes. Apply gel and reattach with new tape.
	Faulty patient cable.	Replace patient cable.
Noise waveform on ECG, and HR gives (- -) in BPM.	Interference on M 71xx screen.	Check the mains plug for proper ground connection. The ground has to be good for better quality waveform display. Connect the unit to a socket with good ground connection.
Respiration waveform and respiration rate not proper.	ECG-LA and RA electrode sites are incorrect.	Resite electrodes.
	Poor electrode contacts.	Resite electrodes.
	Dried electrodes.	Remove electrodes, apply gel and reattach with new tape.
	Faulty patient cable.	Replace patient cable.
Respiration alarms not responding.	Respiration alarm is disabled.	Enable (switch ON) the alarm.
No display and SpO_2 displaying "pulse search".	SpO_2 probe not connected.	Reconnect SpO_2 sensor to patient and secure it properly.
SpO_2 sensor Off/Module error message on screen.	SpO_2 probe not connected.	Reconnect SpO2 sensor to unit. Switch OFF unit and switch ON again. check if all 7 icons pop up. If any of the icons do not pop up, then it indicates a particular module failure e.g. first icon stands for ECG. 'Module Error' in ECG waveform area indicates that ECG module needs attention. Similary for all sections. Call KM authorised service engineer if this problem occurs.
No plethysmograph and (- -) for SpO_2 and PR.	1. SpO_2 module hardware, software failure. 2. No output from SpO_2 module.	Replace SpO_2 module.

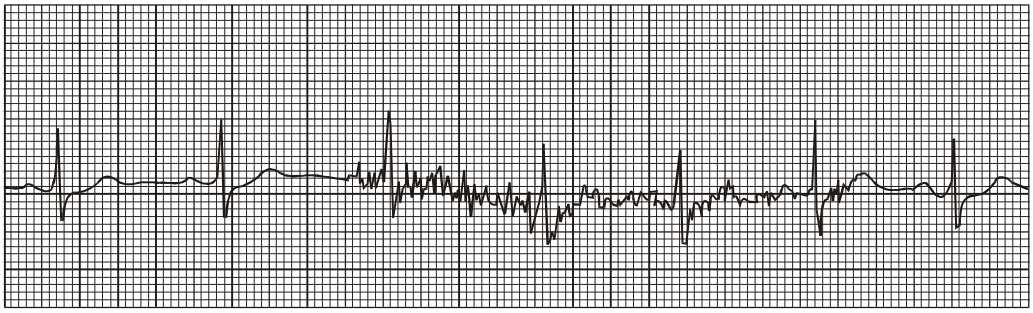
PROBLEMS	CAUSE	CORRECTIVE ACTION
Unit displays 'Check Probe Site'/ Pulse search but SpO_2 and PR are not displayed.	Sensor may be improperly applied to the patient.	Check whether the sensor is properly applied to the patient.
	The patient's perfusion may be too poor for the instrument to detect an acceptable pulse.	Check the status of the patient. Test the instrument on yourself or another person.
	Sensor may be damaged.	Replace it with a new sensor.
Perfusion indicator tracks pulse but there is no oxygen saturation display or pulse rate display.	Patient cable may be damaged.	Try another patient cable, if not possible contact KM authorised service engineer.
	Sensor may be damaged.	Replace it with a new sensor.
	If lesser than 40% of the perfusion indicator is filled, then this perfusion may be too low for the instrument to measure saturation and pulse rate.	Check the status of the patient, check whether the sensor is correctly applied, try another sensor site.
Perfusion indicator tracks pulse but there is no oxygen saturation display.	Excessive patient motion may be making it impossible for instrument to find a pulse pattern.	Ask the patient to remain still if possible. Alternatively check whether the sensor is securely applied, move sensor to a new site, use M 71xx in 'SLOW' response mode in SpO_2 section.
Saturation or Pulse Rate is changing rapidly and perfusion indicator is erratic.	Excessive patient motion may be making it impossible for the instrument to find a pulse pattern.	Ask the patient to remain still if possible. Alternatively check whether the sensor is securely applied, set the unit in 'SLOW' response mode of operation.
	The connector pins may be bent.	Replace it with a new KM sensor.
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 completely wrapped around the limb and must not be loosely attached.
No NIBP reading obtained.	Excessive motion.	Ask the patient to remain still, and realign the cuff properly on the limb of the patient. Select proper cuff size so as to select a wide area of limb coverage.
	Possibility of air leak.	The NIBP tubing must be fixed to the connector of cuff properly without any loose fitting. Recheck connections and tighten them if required.
NIBP "LOOSE CUFF" message	Loss of pressure. Most likely to be an insecure hose connection.	Acknowledge fault, check all hose connections. Repeat measurement. If message is re-displayed, call KM authorised service engineer.
	Punctured cuff or hose.	Replace damaged item.
No Blood pressure waveform.	IBP sensor positioning improper.	Position the sensor properly.
Blood pressure waveform not as expected.	Pressure gain incorrectly set for level being monitored.	Change the gain.
Blood pressure alarms not responding.	Alarm is disabled. Check alarm limits.	Enable (switch ON) the alarm.

PROBLEMS	CAUSE	CORRECTIVE ACTION
Incorrect blood pressure readings.	Blood pressure channel not zeroed.	Zero the instrument.
	Blood pressure sensitivity incorrectly set.	Calibrate the pressure channel.
Pressure is zeroed but has a residual value.	Damaged pressure transducer.	Replace with new transducer and repeat zero function.
No temperature display.	Probes not connected.	Connect the temperature probes.
Temperature alarms not responding.	Alarm is disabled. Check alarm limits.	Enable (switch ON) the alarm.

11.2 Problems Observed During Ecg Monitoring

11.2.1 Patient Related

11.2.1.1 Involuntary Movement



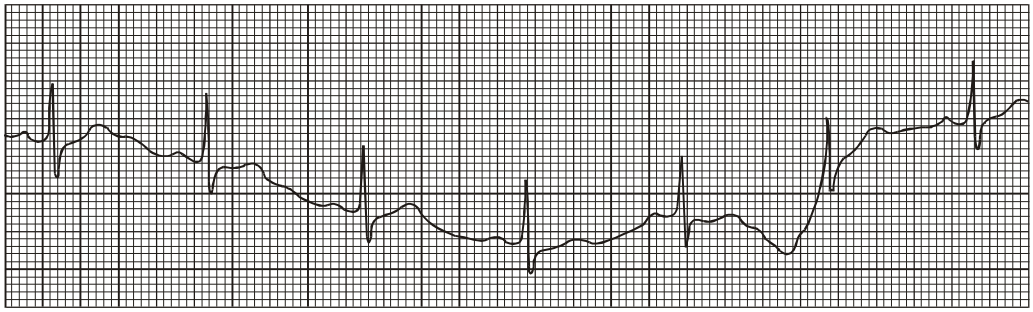
IDENTIFICATION:

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.

11.2.1.2 Voluntary Movement



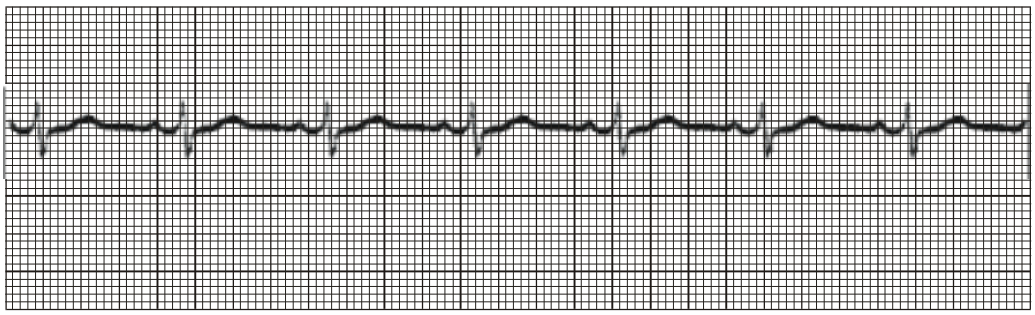
IDENTIFICATION:

Gross body movement will cause severe base line deviation. The signal will continue to be visible, but wanders all over the monitor or paper. 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 will restore confidence. Usually voluntary movement is of short duration . Normal ECG will return when movement stops. Very obese patients often show body movement artifact which may be impossible to completely correct. Run a little extra lead to ensure an accurate reading. If severe artifact results from small body movements, check the electrode application.

11.2.1.3 Poor Skin Prepping



IDENTIFICATION:

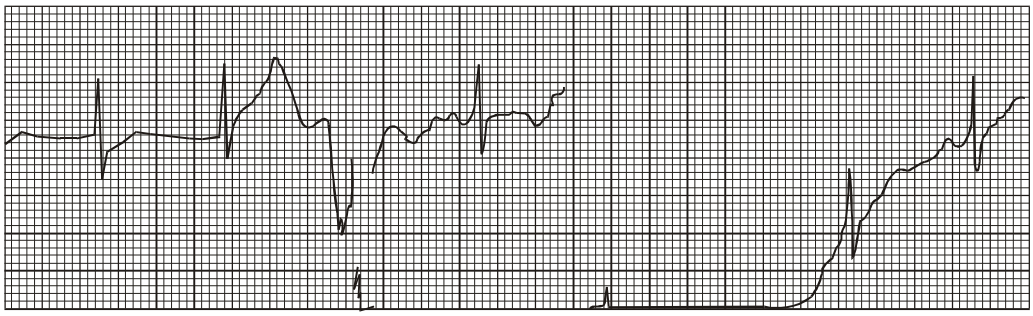
Failure to prep a patient with oily skin will cause low amplitude, wandering base line, and 50 cycle interference. Poor skin prep may not show up right away, but affects the signal as the electrodes remain in place.

CORRECTIVE ACTION:

Cleansing the body oils and dead tissue are essential for proper adhesion and contact of electrodes. The prep area shoud include the whole electrodes site, under the adhesive as well as the contact area. Several preferred methods of skin preparation are : abrasion, alcohol rub, special detergent solutions, and saline wash. When using alcohol or solutions, ensure the area is dry before applying the electrode.

11.2.2 Electrodes Related

11.2.2.1 Loose Electrode



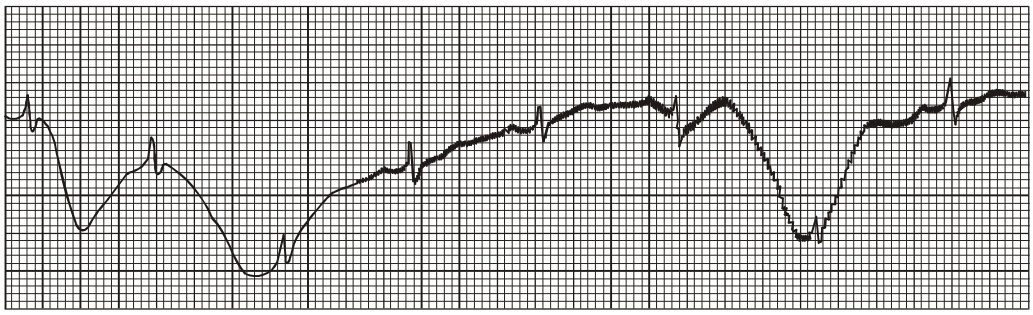
PLACEMENT ON BONY AREA:

An electrode placed on a bony area will show abrupt base line deviation or complete loss of signal. A loose electrode usually has a full amplitude signal some of the time, mixed with intervals of severe artifact. A misapplied electrode usually shows loss of signal height all the time and less drastic base line deviations.

CORRECTIVE ACTION:

Electrodes should be placed on fleshy areas which will allow as flat a placement as possible. Check that the patient cables are not pulling on the electrode and the electrode is maintaining its adherence to the body.

11.2.2.2 Dried out electrode



IDENTIFICATION:

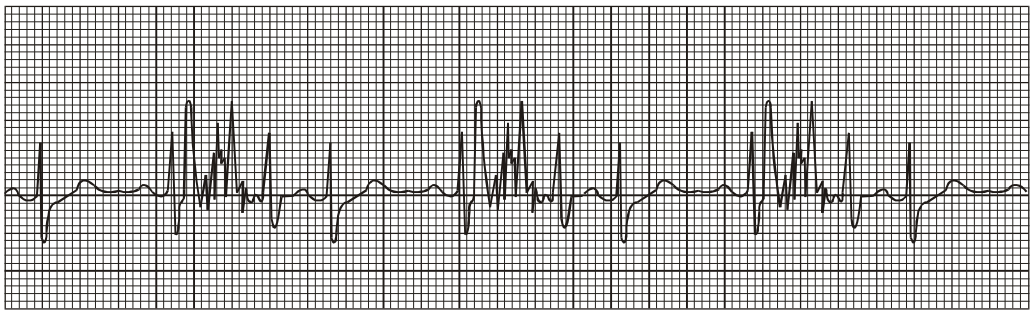
This signal usually degenerates with time. Characteristics such as low amplitude, diphasic QRS complexes, 50 cycle interferences, and base line wonder will usually be present. The trace is consistently rather than intermittently poor.

CORRECTIVE ACTION:

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

11.2.3 Equipment Related

11.2.3.1 Poor Connection



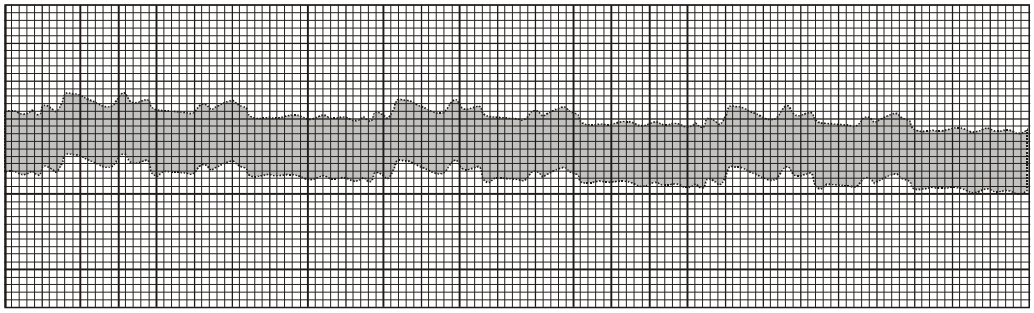
IDENTIFICATION:

Poor connection will look like muscle artifact throughout the entire trace.

CORRECTIVE ACTION:

Check lead wires and junction of cable and electrode to ensure proper connection. If twisting the connector causes the trouble, tighten or replace the defective part.

11.2.3.2 Broken Lead wire



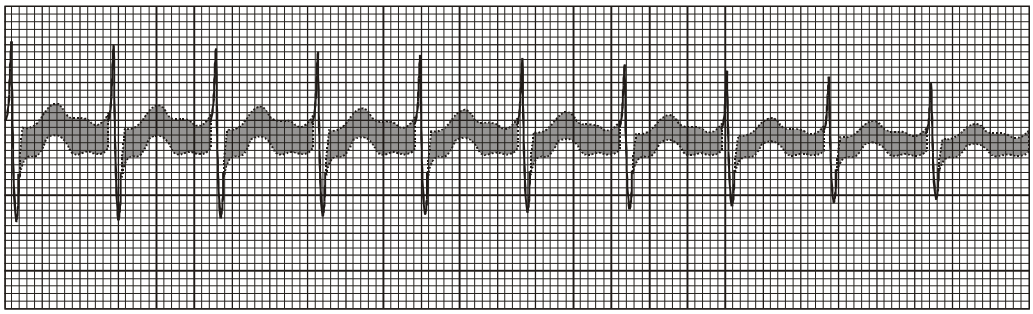
IDENTIFICATION:

Broken lead wire or completely detached electrode will cause pure 50 cycle interference. The QRS complex is almost masked by the extremely wide base line.

CORRECTIVE ACTION:

Check the lead wires, cable and junction for defective part. Replace with new equipment. The use of shielded cables is recommended to protect lead wires from interfering current. Cables should be shielded from the electrode to the monitoring unit.

11.2.3.3 Bad Grounding



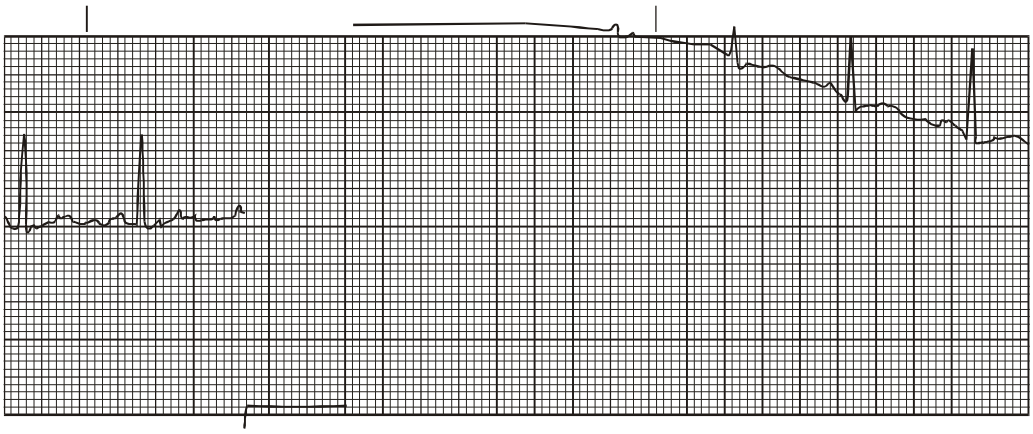
IDENTIFICATION:

Bad grounding may cause 50 cycle interference which is distinguishable in the wide base line.

CORRECTIVE ACTION:

Bad grounding may also create a shock hazard. If in doubt about the grounding connection, do not use it. Request an electrical maintenance check. TV sets, electrical cords near the bed, and fluorescent bed lamps may also cause 50 cycle interference.

11.2.3.4 Static Electricity



IDENTIFICATION:

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

CORRECTIVE ACTION:

Synthetic fabrics in sheets and clothing may generate static electricity. This could disrupt the trace abruptly, and without patient movement, especially if cables having exposed connectors are used.

12. TECHNICAL SPECIFICATIONS

12.1 Equipment Classification

Mode of operation	:	Continuous
Degree of mobility	:	Portable
Type of protection against electric shocks	:	Class I
Degree of protection against electric shock	:	Type CF-ECG, IBP1, IBP2, T1, T2 and RESPIRATION Type BF-SpO_2, NIBP and CO_2 (CO_2 optional under development).
Degree of protection against hazards of explosion	:	Not protected
Degree of protection against ingress of liquids	:	Drip proof

Power Supply

Voltage	:	180 – 264V AC, 50Hz (± 5%)
Fuse	:	3.15A slow 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.
Wattage	:	60 Watts

Battery

Type	:	6V, 4A hr LEAD ACID sealed (2 Nos.)
Operation	:	40 minutes on fully charged new battery at 25°C

Low Battery Indication

Voltage	:	11.4 ± 0.2V
Indicator	:	Green LED ON and Amber LED OFF indicates battery operation. Green LED ON and Amber LED ON indicate mains operation and battery charging. Green LED flashes to indicate LOW BATTERY and message is displayed on screen.

External Battery Rating

Voltage	:	12V
Current	:	2A (min.)

Controls

Front panel	:	1 switch for MONITOR ON/OFF control. 5 SPECIFIC FUNCTION switches. 1 OPTICAL ENCODER with switch.
Back panel	:	1 MAINS ON/OFF switch.
Adult/Neonate option	:	Provided (User selectable).

Display

Screen	:	High resolution Electro Luminiscent display. Dot pitch 0.258 mm. Active display area 165 mm x 124 mm (640 x 480 dots)
Trace speed		12.5, 25, 50 mm/sec for ECG, SpO_2, IBP1 and IBP2. 6.25, 12.5, 25 mm/sec for RESPIRATION & CO_2.
Waveform	:	Four waveform display. Four pre-configured formats and one user selectable format.
SpO_2 strength indicator	:	Bar graph showing the signal strength.
Waveform sampling rate	:	400 samples/sec for ECG (max.) 100 samples/sec for SpO_2 (fixed) 100 samples/sec for IBP1 (fixed) 100 samples/sec for IBP2 (fixed) 100 samples/sec for RESPIRATION (fixed)
Heart Rate display	:	3 digits (24 x 40 pixels) each. Updation every alternate second.
SpO_2 % display	:	3 digits (24 x 40 pixels) each. Updation every alternate second.
Pressure display	:	3 digits (16 x 24 pixels) each for SYS & DIA 3 digits (8 x 10 pixels) each for MEAN. Updation every alternate second.
Respiration	:	3 digits (16 x 24 pixels) each. Updation every alternate second.
Control status display	:	562 x 20 pixels MENU bar at the bottom of the display showing the currently active options.
Printer indication	:	PRINTING..... message in the message area indicates printing in progress. PRINTER ERROR message to indicate PAPER OUT or PRINTER OFF conditions.
Recording Indication	:	RECORDING..... message in the message area indicates recording in progess.
Arrhythmia indicator	:	FLASHING RED ALARM and arrhythmia type in MESSAGE area on screen. Last 3 arrhythmias displayed.
Alarms detection status	:	Selected limits shown if enabled. Crossed BELL symbol shown if disabled.

Trends :

HR, SpO_2%, IBP1, IBP2, T1, T2, & RESPIRATION : 24 hours graphical and tabular trend for display.

NIBP : Last 240 readings will be displayed in tabular format.

Trend time scales : 2 hours (resolution 30 sec) and 12 hours (resolution 3 minutes) for graphical trend.
6 minutes resolution for tabular trend.

Alarm trend (recall) : Tabular trend for display of last 16 patient alarms, violation of all parameters and arrhythmia conditions.

Auto Setting of Alarms : Provided for HR, SpO_2, IBP, RR and TEMP.
Formula used :
HR high limit = Present HR value x 8/10 + 54
HR low limit = Present HR value x 8/10 + 4
SpO_2 high limit = 100
SpO_2 low limit = (Present SpO_2 value – 8) or 80 whichever is greater
IBP1 and IBP2
Systolic high limit = Present Systolic value + 8
Systolic low limit = Present Systolic value – 8
Diastolic high limit = Present Diastolic value + 8
Diastolic low limit = Present Diastolic value – 8
Temperature
T1 high limit = Present T1 value + 2
T1 low limit = Present T1 value – 2

Inputs

Side panel : 7 pin Hypertronics connector for ECG
7 pin Redel/Lemo connector for SpO_2
6 pin Redel/Lemo connector for IBP1
6 pin Redel/Lemo connector for IBP2
Female coupling for NIBP

Power : Standard 3-pin IEC power connector.
Live and neutral lines with fuse.

ECG

Input : Isolated and floating 3/5 leads. (depending on ECG cable)
Protected against surges produced by ESU and defibrillator potentials.

Input impedance : > 3 MΩ at 10 Hz.

CMRR : > 120 dB LA, RA, LL, RL, V to equipotential ground at 50 Hz.
60 dB LA, RA, LL, V to RL at 20 Hz.

Leakage current : < 10 µA at 240 V/50 Hz.

Overload recovery : < 0.25 sec.

Fault indication : Cable / Electrode

CAL	:	On screen CAL indicator for 1 mV gain of lead II.
Bandwidth	:	0.5 – 25 Hz for Monitoring mode 0.05 – 25 Hz for Diagnostic mode.
Gain	:	2mV, 1mV, 0.5mV, 0.2mV – user selectable.
Tall T wave rejection	:	Upto 1.2mV of QRS amplitude.
QRS beep volume control	:	25 steps (Off to High)
Leads	:	a) 5 leads (for 5 lead cable) b) 3 leads (for 3 lead cable)
QRS indicator	:	Beep and ❤ indicator for every QRS complex detected.
Heart rate range	:	20-270 bpm
Accuracy	:	2 bpm or 2% whichever is greater.
HR alarms	:	Adjustable alarm limits Min – 30 to 250 bpm Max – 50 to 270 bpm 4 seconds delay for HR alarms 5 seconds R-R interval triggers asystole alarms if selected in arrhythmia menu.
Arrhythmias detected	:	Irregular, Skipped beat, Tachycardia, Bradycardia and Asystole. (selectable).

Respiration

Input	:	From ECG cable.
Leakage current	:	< 10 µA at 240 V, 50Hz
Excitation current	:	< 300 µA at 50kHz.
Sensitivity (Max)	:	0.2 ohm/cm.
Sensitivity (Min)	:	4 ohm/cm.
Range	:	4-150 bpm.
Accuracy	:	upto 30, ± 1 bpm 30 - 60, ± 2 bpm > 60, ± 4 bpm
"RESP" indicator	:	Flashing indicator for every valid breath detected.
Fault indication	:	Cable/Electrode fault indication
GAIN	:	Four user selectable gain levels are provided (x1, x2, x3, x4). x3 is default gain level for adult application.
APNOEA alarm delay	:	5-90 seconds (selectable) in steps of 5 seconds.

Pressure

Input	:	Isolated and floating. Protected against surges produced by diathermy/electrosurgical unit, defibrillator potential with KM approved cables.
Input impedance	:	> 1MΩ.
Leakage current	:	<10 µA at 240V, 50Hz.
Processed pressure signals	:	Systolic, Diastolic and Mean.

Accuracy	:	2 mmHg or 2%, whichever is greater.
Bandwidth	:	D.C. to 20Hz.
Sensitivity	:	5 µV / V / mmHg of transducers.
Transducer excitation	:	2.6V DC short circuit protected and isolated.
Auto zero	:	Front panel control Capture range : ± 100 mmHg. Zero message appears in the pressure field when zeroing is required.
Pressure ranges	:	-40, 10, 20, 30, 60, 150 & 300 mmHg. "Out of range" indication is provided if the pressure exceeds the set range.
Calibration	:	100 mmHg signal injected to the screen.
Alarms	:	Adjustable alarm limits.

LABEL	MEAN		SYSTOLIC		DIASTOLIC	
	Min	Max	Min	Max	Min	Max
IBP	50	130	60	140	50	130
ICP	10	26	12	28	10	26
CVP	5	13	6	14	5	13
PAP	10	26	12	28	10	26
LAP	10	26	12	28	10	26
RAP	10	26	12	28	10	26
LVP	25	65	30	70	25	65
ART	50	130	60	140	50	130

Table 1: Pressure Adult

LABEL	MEAN		SYSTOLIC		DIASTOLIC	
	Min	Max	Min	Max	Min	Max
IBP	30	55	45	80	20	45
ICP	6	11	9	16	4	9
CVP	3	5	4	8	2	4
PAP	6	11	9	16	4	9
LAP	6	11	9	16	4	9
RAP	6	11	9	16	4	9
LVP	15	27	22	40	10	22
ART	30	55	45	80	20	45

Table 2: Pressure Neonatal

Temperature

Inputs	:	Isolated and floating.
Leakage current	:	<10 µA at 240V, 50Hz.
Measurement range	:	12°C – 43°C.
Scale value	:	Displays direct readings of temperature input. ΔT value displayed in place of T2 if difference between T1and T2 is less than 9°C.
Warm up	:	< 10 minutes (excluding probe)
Accuracy	:	± 0.2°C and ± 0.4°F
Linearity	:	± 0.1°C
Alarms	:	Temperature limits adjustable Minimum 12°C to 42°C Maximum 13°C to 43°C
Unit	:	°C or °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 is also indicated if the temperature rises above 43°C or falls below 12°C. If a fault is present in the temperature measuring circuit, the message FAULT will be displayed.
Calibration	:	Injects signal of (37.0 ± 0.1)°C into both inputs.

SpO_2

Tone variation with change in SpO_2	:	Provided
Measurement range	:	0-100%
Accuracy	:	100-70% ± 2 digits 69-50% ± 3 digits 49-0% unspecified (neonates 70-100% ± 3 digits)
Alarms	:	Adjustable alarm limits Min. 80 to 95% Max. 85 to 100%

NIBP

Method	:	Oscillometric, microprocessor software eliminates most ambient noise and motion artifact.
Display	:	Systolic, Diastolic and Mean.
Modes of measurement	:	MANUAL, AUTO & STAT mode. In AUTO mode intervals of 2,3,4,5,10,15,30,60 and 90 minutes are user selectable. In STAT mode unit will take as many readings as possible in 5 minutes. Duration between each measurement is 5 seconds.
Range	:	20-250 mmHg
Accuracy	:	± 5 mmHg with a standard deviation no greater than 8 mmHg.
Cuffs	:	Single quick connect hose
Auto zero	:	Zero pressure reference is automatically established after every readings.
Cuff inflation	:	Initial inflation to 180 mmHg for ADULT and 100 mmHg for NEONATES. Subsequent inflation to approximately 30 mmHg greater than previous systolic pressure.
Cuff deflation	:	Automatic
Safety features	:	Automatic deflation if: - cuff pressure exceeds 280 mmHg. - measurement time exceeds 90 seconds. - safety timer detects microprocessor failure.

Alarms:

Accessory alarms	:	Audio (alarm beep). Visual (flashing Yellow LED) and message indication.
Patient alarms	:	Audio (alarm beep). Visual (flashing Red LED) and message indication.
Alarms suspend	:	Continuous Yellow LED to indicate “Alarms Suspend” condition with message indication.
Alarms mute (patient alarms)	:	3 minute realarm provided in case alarm condition persist after alarm acknowledge.
Alarm volume control	:	25 steps (min to high)

Outputs :

SYNC	:	Provides 1 V ECG signal for sync defibrillation.
Analog	:	9 pin D sub connector (female) provided output for external recorder. Pin 1 : Record strobe signal. Active LOW. Pin 2 : ECG waveform (1 V/mV) Pin 3 : %SpO_2 Pin 4 : Pleth waveform Pin 5 : HR Pin 6 : IBP 1 Pin 7 : GND Pin 8 & 9 : No connection
Analog O/P bandwidth	:	30Hz for ECG 20Hz for IBP1, IBP2, SpO_2
CNS interface	:	3 pin DIN for communication
Printer	:	25 pin D sub connector (female). Parallel Centronics Interface for tabular printout of trend data.

General

Dimension (H x W x D)	:	202 x 310 x 230 mm.
Weight	:	7.5 Kg (approx.) with batteries.
Operating temperature	:	0 to 40°C
Operating humidity	:	10 to 90% RH (Non condensing)
Storage temperature	:	-10 to 50°C
Storage humidity	:	0 to 90% RH (Non condensing)
Operating pressure	:	500 to 900 mmHg.
Storage pressure	:	500 to 900 mmHg.

Accessories supported

ECG	:	3 lead or 5 lead cable with electrodes.
SpO_2	:	NELLCOR probes : DS (Durasensor) 100A (Adult) Oxy-A/N (Adult/Neonate) Dura Y (Universal) – ear clip
IBP	:	Disposable transducer kit
Temperature	:	YSI 400 series temperature probes.
NIBP	:	CAS MEDICAL SYSTEMS Tuff-Cuff resuable blood pressure cuffs (infant to large adult sizes)

Standards

Designed to conform to the following international standards.

Class 1, Type CF equipment requirement of IEC601-1.

Level 2 requirement of IEC 1000-4-4 & IEC 1000-4-5 standards.

12.2 Warranty And Warranty-Service

KM warrants its medical equipment against only manufacturing defects for a period of 12 (twelve) months from the date of installation or 15 (fifteen) months from the date of despatch, whichever is earlier.

During the warranty, KM will, at its option, either repair or replace the defective components / assemblies free of charge. The defective part shall be sent duly packed to KM's concerned office / service station at purchaser's cost including freight, insurance and forwarding charges. Other claims, particularly claims for compensation, are excluded.

The warranty shall by valid only if installations and repairs are carried out by KM's engineers or authourised dealers.

The warranty shall not apply to defects resulting from :

1. Unauthorised modification / misuse / mishandling of the equipment.
2. Operation of the equipment outside the environmental specifications of the product (e.g., temperature, electrical requirements, etc.)
3. Improper site preparation and site maintenance.
4. Any other reason external to the equipment (e.g., accidents, vibration, etc.)

KM shall not be liable for any special or consequential damages of any kind or nature. KM 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.

LABEL	MEAN		SYSTOLIC		DIASTOLIC	
	Min	Max	Min	Max	Min	Max
IBP	50	130	60	140	50	130
ICP	10	26	12	28	10	26
CVP	5	13	6	14	5	13
PAP	10	26	12	28	10	26
LAP	10	26	12	28	10	26
RAP	10	26	12	28	10	26
LVP	25	65	30	70	25	65
ART	50	130	60	140	50	130

Table 3: Pressure Adult

LABEL	MEAN		SYSTOLIC		DIASTOLIC	
	Min	Max	Min	Max	Min	Max
IBP	30	55	45	80	20	45
ICP	6	11	9	16	4	9
CVP	3	5	4	8	2	4
PAP	6	11	9	16	4	9
LAP	6	11	9	16	4	9
RAP	6	11	9	16	4	9
LVP	15	27	22	40	10	22
ART	30	55	45	80	20	45

Table 4: Pressure Neonatal