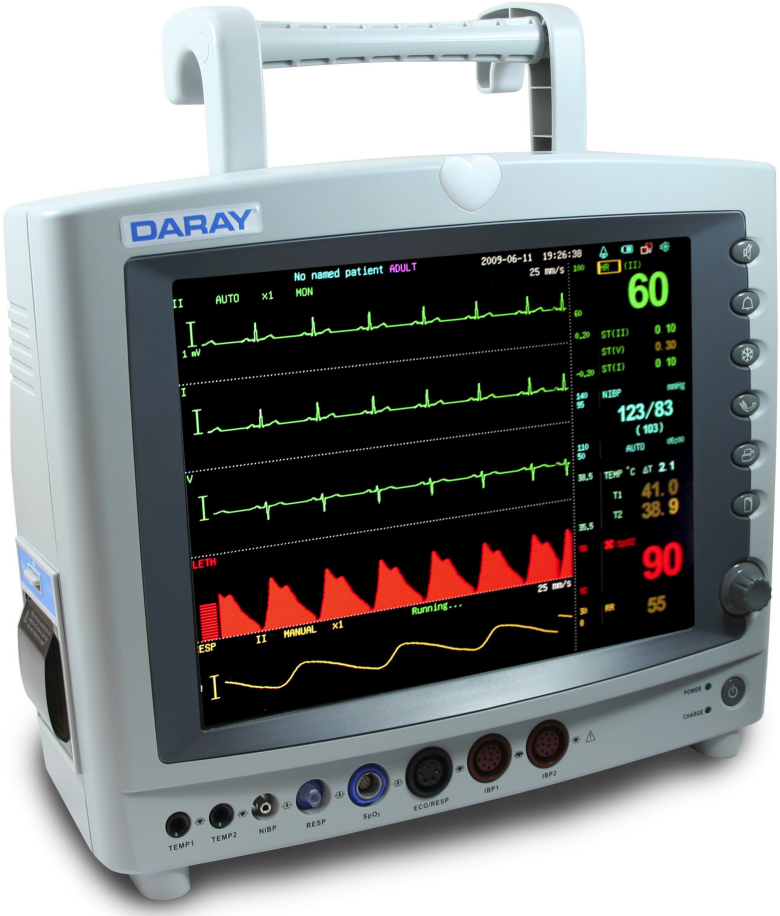
DARAY®
Medical



L550

PATIENT MONITOR
OPERATING MANUAL

QAM.L550.1112.2

Preface

This manual has been provided to give detailed descriptions on DARAY's L550 patient monitor, covering the performance, operation and safety information of the device. It is recommended reading through this manual before using the L550 so that you are more aware of how to use the L550 and all of its features.

This manual is intended for use by people who are trained in the use of and have adequate experience of monitoring equipment.

Throughout this manual, text highlighted in red is displayed. Users should read this text as it is designed to avoid injury and damage. The following are examples of what is displayed and what it means.

WARNING: Gives advice on how to avoid injury to the patient and user.

CAUTION: Gives advice on how to avoid damage to the monitor or equipment.

NOTE: Gives advice which should be written down for easy future reference.

It is advised that the hospital or organisation carry out regular maintenance and cleaning of the L550, failure to do so may result in malfunctioning of the device, inaccurate and unreliable data output or injury to the patient or user.

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1. INTRODUCTION

Before using the L550, the user should carefully read this manual in order to correctly operate the L550, allowing it to reach specified safety standards and perform correctly and efficiently.

The L550 multi-parameter patient monitor is a multifunctional monitor, designed to monitor ECG, NIBP, SpO2, PR, RESP, TEMP, IBP and CO2.

The L550 comes with accessories including an ECG cable, BP cuff, SpO2 sensor, TEMP sensor, BP hose, IBP sensor, dehydration vase and sampling line.

The L550 also has three input/output connectors for an external recorder, network communications and an external VGA monitor.

Classification

Type of protection against electric shock

Class I, internally powered equipment.

Degree of protection against electric shock

type CF applied part.

type BF applied part.

Degree of protection against ingress of water

Not protected (ordinary).

Method of sterilisation or disinfection recommended by DARAY

Equipment with method of sterilisation or disinfection recommended by DARAY

Degree of safety of application in the presence of a flammable anaesthetic mixture with air or with oxygen or nitrous oxide

Equipment not suitable for use in presence of flammable anaesthetic gas.

Mode of operation

Continuous operation

NOTE

- The symbol ⚠ means: Attention - refer to the accompanying the manual.
- Every symbol ⚠ in the manual means that when you operate this equipment, be more attentive to help ensure the safety of the patient, the operator and the equipment.

WARNING

- Do not use the L550 for asphyxiation monitoring.
- Do not use the L550 during magnetic resonance imaging (MRI) or CT scanning.
- Do not use the L550 in the presence of inflammable anaesthetics or gases.
- The user must provide an earthed power socket in accordance with national standards.
- To ensure the patient safety, check the device and accessories work safely and normally before use.
- Only used DARAY approved accessories with this monitor.
- The ECG cable uses either a five-lead or three-lead cable, and cannot be connected to other signal terminals on the device.
- In order to save time during diagnosis and treatment, configure the alarm settings according to different conditions of each patient.
- When using the L550, the F-type applied parts (BF or CF) must not be connected to any other conductor or earthing.
- When using electrosurgery units during monitoring, the electrosurgery unit loop should be properly connected to prevent burning, injury or death.
- When numerous pieces of equipment are connected to the same patient, pay attention to the danger of cumulative current leakage.
- The L550 has no defibrillation synchronization, so it cannot be connected to synchronization defibrillation instruments.
- Magnetic and electrical fields can interfere with the correct performance of the device. For this reason, make sure that all external devices operating in the vicinity of the monitor comply with relevant EMC requirements. Mobile phone, X-ray equipment or MRI devices are possible sources of interference as they may emit higher levels of electromagnetic radiation.
- EXPLOSION HAZARD: Do not use the L550 in the presence of flammable anaesthetics or explosive substances, vapours and liquids.
- Keep the L550 dry, prevent ingress of water/liquids and high humidity. Avoid strong vibration.
- ELECTRIC SHOCK: Do not open the monitor housing. All servicing and future upgrades to this device must be carried out by DARAY.
- Do not put the L550 in high temperature, high pressure, gas fumigation or liquid immersion environments. Before cleaning or sterilising the monitor, disconnect from the mains.
- At the end of its service life, the L550 and its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products.

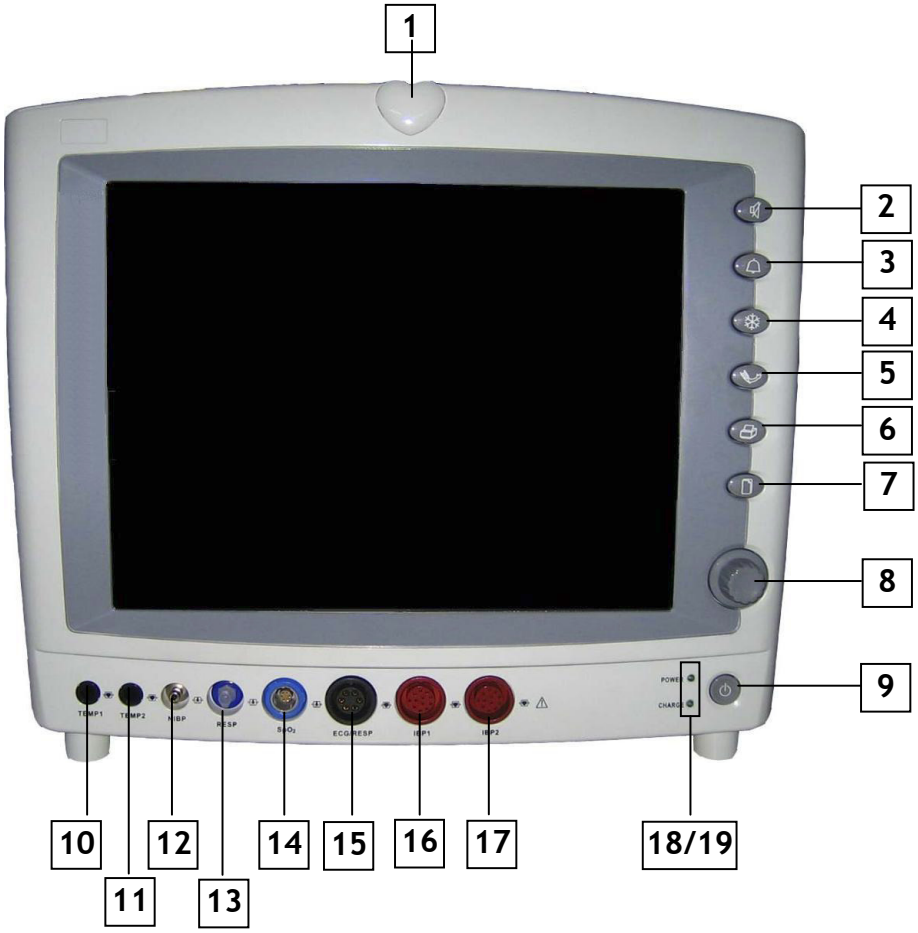
FUNCTION

The L550 monitors: electrocardiogram (ECG), body temperature (TEMP), impedance respiration (RESP), oxygen saturation (SpO2), invasive blood pressure (IBP), non-invasive blood pressure (NIBP) and CO2 (EtCO2 and FiCO2). It integrates the parameter measurement, display and recorder, forming a compact and portable monitor.

The monitor is capable of monitoring the following parameters:

- Electrocardiogram (ECG): heart rate (HR), 3-lead or 5-lead ECG waveforms and ST segment analysis.
- Non-invasive blood pressure (NIBP): systolic pressure (SYS), diastolic pressure (DIA) and mean arterial pressure (MAP).
- Body temperature (TEMP): temperature of channel 1 (T1), temperature of channel 2 (T2) and temperature difference between the two channels (.T).
- Pulse oxygen saturation (SpO2): SpO2, pulse rate (PR) and SpO2 plethysmogram.
- Respiration: respiration rate (RR) and respiration (impedance respiration or nasal tube respiration) waveform.
- Invasive blood pressure (IBP): 2 channels of IBP waveforms, systolic pressure (SYS), diastolic pressure (DIA) and mean pressure (MEAN).
- Carbon dioxide (CO2): end-tidal carbon dioxide (EtCO2), fractional inspiratory carbon dioxide (FiCO2) and CO2 waveform.

Front panel



1. **Alarm indicator** - When a parameter value exceeds its alarm limit, this indicator flashes red ,once a second.

2. **Mute button** - Press to start or stop monitor tones, including heart beat tones, pulse tones and error prompt tones. Pressing this button consecutively will silence the system for 30 seconds, 60 seconds, 120 seconds or until the next time the tones start. At this time, the silence status icon displayed in the status bar changes from to with the time the tones will start again displayed to the right, e.g. 30. When the time counts down to zero, or the mute button is pressed, whilst the monitor is silenced, tones are restored.

3. **Alarm button** - Press to enter alarm menu.

4. **Freeze button** - Press to freeze and unfreeze waveforms.

5. **NIBP button** - Press to start or stop non-invasive blood pressure measurement.

6. **Print button** - Press to start or stop waveforms and measured parameter values printing.

7. **Main menu button** - Press to display the main menu or exit the current menu.

8. **Rotary controller** - Turn the rotary controller in either direction to highlight

titles and menu options. After highlighting the desired selection, click the knob to execute an operation, make a selection and view a new menu or dialogue box. This procedure is referred to as 'select' throughout the manual.

Remember rotate to highlight, and then click to select.

9. ⏻ Power switch - press and hold for more than two seconds to turn the monitor on or off.

10. **TEMP1** - Temperature probe socket (channel 1)

11. **TEMP2** - Temperature probe socket (channel 2)

12. **NIBP** - NIBP cuff hose socket

13. **RESP** - Respiration pipe socket

14. **SpO2** - SpO2 probe socket

15. **ECG/RESP** - ECG cable socket

16. **IBP1** - IBP transducer socket (channel 1)

17. **IBP2** - IBP transducer socket (channel 2)

18. **POWER** - Power indicator

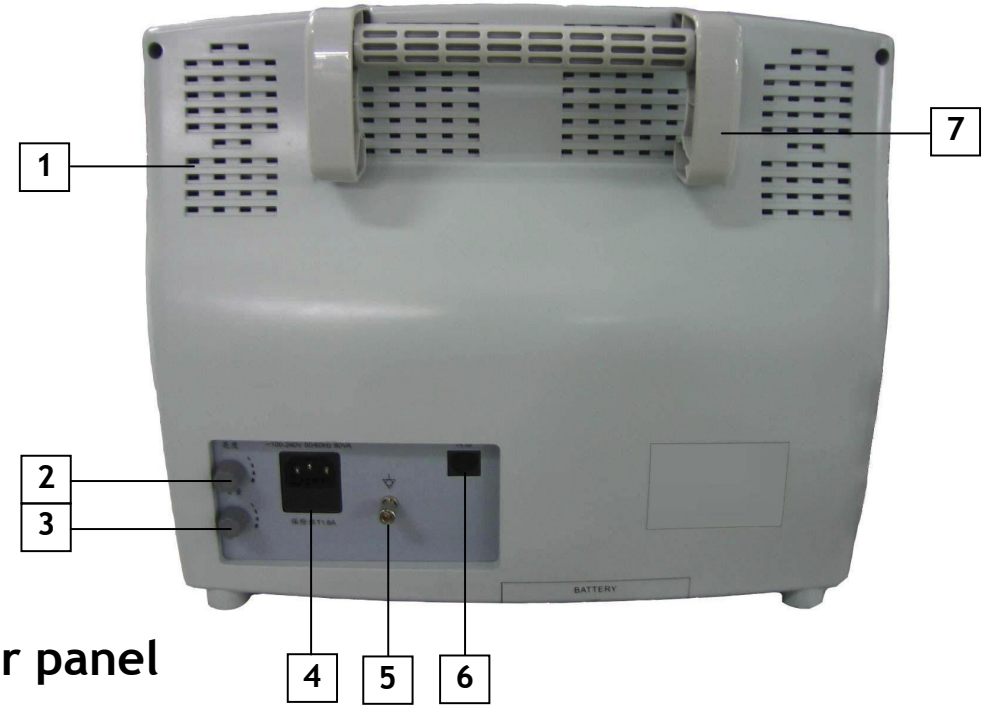
19. **CHARGE** - Charging status indicator

    ON: AC power is connected.

    OFF: AC power is not connected.

Type CF (cardiac floating) applied parts. The unit displaying this symbol contains an F-type isolated (floating) patient part providing a high degree of protection against shock. Type CF is the most stringent classification and is required for applications where the applied part is in direct conductive contact with the heart or perhaps other applications if considered necessary.

Type BF applied part. Type BF is less stringent than CF, and is generally for devices that have conductive contact with the patient, or having medium or long term contact with the patient.

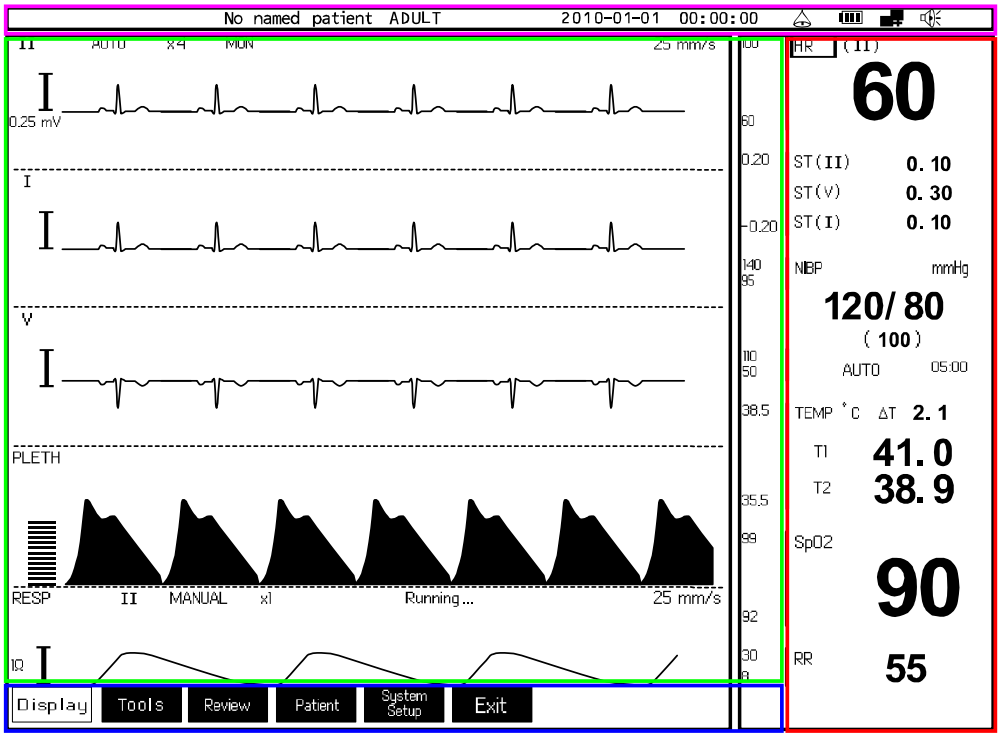


Rear panel

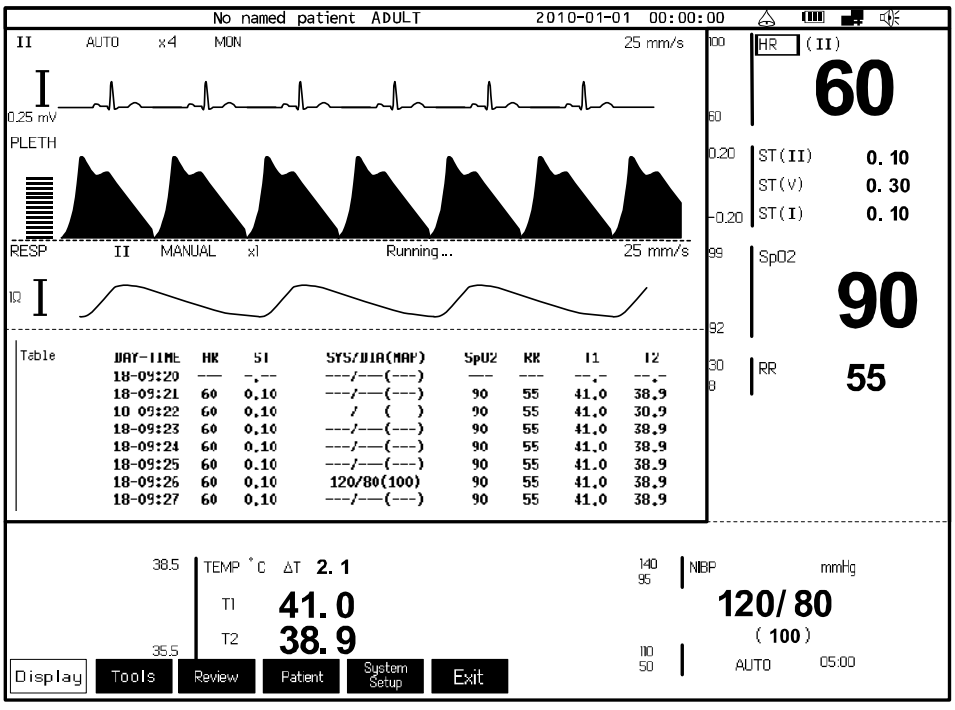
1. Vents
2. ☼ Brightness adjustment.
3. Volume adjustment.
4. Fuse socket.
5. Equipotential earth point.
6. Network connector: Through network connection, the L550 can be connected to a central monitoring system, another patient monitor, or a PC, enabling the different patient viewing, data output and software upgrading.
7. Battery cover
8. IEC AC power connector.
9. Fold-away carry handle/hook.

DISPLAY

The display of the L550 is divided into four areas: channels [1], parameters[2], status bar[3] and menu bar[4]. Parameters are always displayed on the right hand of the screen. When the menu is displayed part of the channels area and parameters area is obscured. The standard display interface is shown below:



The L550 provides a channels area configuration function. Through channels settings, the monitor displays an interface where the parameters are displayed on the right and lower parts, as below.

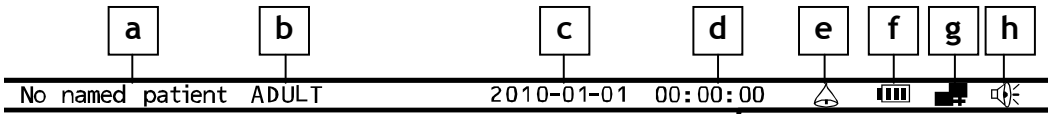


1. **Channels area** - The channels area is divided into several channels, and can be changed between ECG waveform, RESP waveform, PLETH waveform, IBP waveform, CO2 waveform, trend graph and trend table. The channel's title is usually displayed on the upper left corner of the channel. Selecting the title will enter the corresponding menu. Displayed in the same row of the title is the status information concerning this channel.

2. **Menu bar** - The menu bar automatically is displayed and disis displayed. Pressing the main menu button, alarm button, freeze button or the parameter/channel titles can activate the corresponding menu to display.

3. **Parameters area** - The heart rate (HR), pulse oxygen saturation (SpO2), respiration rate (RR), body temperature (T1/T2), noninvasive blood pressure (NIBP), invasive blood pressure (IBP), end-tidal carbon dioxide (EtCO2) and fractional inspiratory carbon dioxide (FiCO2) are displayed in this area. Every parameter has a corresponding title with an alarm prohibition icon on the left side. Selecting the title will enter the corresponding menu.

4. **Status bar** - Display the monitor status information and patient's information.



a. **Patient name**: The patient name can be set in the 'Patient Information' dialogue box. If the patient isn't named, 'No named patient' is displayed

b. **Patient type**: The patient type can be set to either adult, paediatric or neonate

c. Set the system date and format

d. Set the system time

e. **Alarm status**:

   i. Physiological alarms enabled

   ii. Physiological alarms disabled

f. **Battery status**: Denotes the capacity in the battery

g. **Network status**:

   i. Disconnected from the central monitoring system

   ii. Connected to the central monitoring system

h. **Silence status**:

   System not silenced

   System silenced

WARNING:

The system does not produce physiological alarms if the icon is displayed.

BATTERIES

The L550 is designed to operate on battery power during patient transfer or when the power supply is interrupted. The battery is charged automatically when the L550 is connected to AC power, whether the monitor is powered on or not.

The battery symbol in the status bar shows the power capacity of the battery.

 The battery is installed and charged; the power capacity is indicated by the number of boxes (three = full capacity, two = medium, one = low).

 (flashing) - No battery is installed or the battery needs charging.

The charge indicator also indicates the battery's status.

ON - The battery is being charged or is fully charged.

OFF - No battery is installed or the battery is installed but the monitor is not connected to AC power.

The battery power capacity is limited; when the battery capacity is too low, the flashing red symbol shows in the status bar. As soon as this symbol is displayed, the monitor should be connected to AC power.

NOTE:

Remove the battery before transportation of the monitor or during long periods of time when the monitor will not be used.

WARNING:

- Keep the battery out of the reach of children.
- Only use the battery specified by the manufacturer.

BATTERY MAINTENANCE

Conditioning a battery

Batteries should be conditioned before use for the first time. A battery conditioning cycle is one uninterrupted charge of the battery. Batteries should be conditioned regularly to maintain their life. Condition a battery once when it is used or stored for two months, or when its run time becomes noticeably shorter.

To condition a battery:

1. Disconnect the L550 from the patient and stop all monitoring.
2. Insert the battery being conditioned in the battery slot of the L550.
3. Connect the L550 to AC power and allow the battery to charge uninterrupted for ten hours.
4. Remove AC power and run the L550 from the battery until it powers off.
5. Apply AC power again to the L550 and allow the battery to charge uninterrupted for ten hours.
6. The battery is now conditioned and the L550 can be returned to service.

NOTE:

- Life expectancy of a battery depends on how frequent and how long it is used. For a properly maintained and stored lead-acid or lithium ion battery, its life expectancy is about 2 or 3 years respectively. For more aggressive use, life expectancy can be less. We recommend replacing lead acid batteries every 2 years and lithium ion batteries every 3 years.
- The battery may be damaged or malfunctioning if its operating time is too short after being fully charged. The operating time depends on the configuration and operation. For example, measuring NIBP more frequently will also shorten the operating time.

BATTERY RECYCLING

When a battery has visual signs of damage, or no longer holds a charge, it should be replaced. Remove the old battery from the monitor and recycle it properly. To dispose of the batteries, follow local laws for proper disposal.

WARNING: Do not disassemble batteries, or dispose of them in fire, or cause them to short circuit. They may ignite, explode, leak or heat up, causing injury.

INSTALLATION

WARNING

- The software copyright of the L550 is solely owned by our company. Any action to change, copy or exchange the software copyright by any organization or person is regarded as copyright infringement and is not allowed.
- If the monitor is connected to another electrical instrument and the instrument specifications cannot tell whether the instrument combination is hazardous (e.g. due to cumulative of leakage currents), you should consult us or experts in the field to ensure the required safety of all instruments concerned.

NOTE: The operations in this section are not all required. User-customized installation by authorized personnel is provided.

UNPACKING AND CHECKING

1. Open the packaging according to the positions marked on the packing case, and remove the monitor and accessories carefully.
2. Check the accessories against the packing list.
3. Check the L550 and the accessories for any damage.

Contact DARAY in case of any problem.

NOTE: Save all packaging material for further transport and storage.

WARNING:

- Keep packaging materials away from children.
- Disposal of packaging materials should comply with local laws.
- The equipment can be contaminated in storage, transport or when used. Check the packaging and the single use accessories are intact. In case of any damage, do not apply to patients.

ENVIRONMENTAL REQUIREMENTS

The operating environment of the L550 must meet the requirements specified in *environmental specifications* of the appendix.

The environment should be free from noise, vibration, dust, and corrosive or explosive and inflammable substances. Do not place the monitor against or too close to a wall. Do not block any of the vents on the back and sides of the monitor as this will cause poor air circulation.

Condensation can form when the monitor is moved from one location to another, and exposed to differences in humidity or temperature. Make sure that during operation the instrument is free from condensation.

INSTALLATION METHOD

Connect the L550 to an AC power supply using the supplied IEC power cable.

The power socket must be earthed.

WARNING:

- Confirm the AC power supply conforms with the requirements of this equipment: (100 ~ 240V AC, 50/60Hz).
- Do not use a three-wire to two-wire adapter with the L550.

INSTALLING THE BATTERY

1. Slide the battery cover in the indicated direction.
2. Insert the battery into the battery slot according to the '+' and '-' symbols.
3. Cover the battery with the plate and fix in place with retaining screws.
4. Close the battery door.

WARNING:

- Make sure the monitor has been disconnected from the mains before installing the battery.
- Make sure the battery door or the rear panel is closed securely. Loose batteries could seriously injure a patient or user.

EARTHING

When other equipment is used with the L550, the earth cable should be used to connect the earth of the monitor and of other equipment. This helps to reduce the potential differences between pieces of equipment, and ensure the safety of the operator and patient.

WARNING:

- If the integrity of the earth bond is in doubt, the L550 must be powered by its internal battery.
- Accessories connected to the L550 must be certified according to the respective IEC standards (e.g. IEC 60950 for information technology equipment and IEC 60601-1 for medical electrical equipment). Furthermore all configurations should comply with the valid version of the system standard IEC 60601-1-1. Any person who connects additional equipment to the signal input or signal output is responsible to ensure the system complies with the requirements of the valid version of the system standard IEC 60601-1-1. If in doubt, contact DARAY.

CONNECTING PATIENT SENSORS AND PROBES

Connect the necessary patient sensors or probes to the monitor. For details, see the chapters for specific parameter monitoring in the following pages, or corresponding instructions for sensors and probes.

CONNECTING THE NETWORK CABLE

The network connection of the L550 is a standard RJ45 connector. It connects the

monitor to a central monitoring system, or with a PC for upgrading or data output. It can also connect with another patient monitor for other patient viewing.

1. Connect the network cable to the monitor.
2. Connect the other end of the network cable to a hub or switch of the central monitoring system, or with the network connector of a PC, or with the network connector of another patient monitor.

WARNING:

- Different network cable may be used for different connections. Please consult our customer service personnel for details.

CONNECTING A VGA MONITOR

The L550 can be connected to a standard colour VGA monitor. The VGA monitor will display the patient waveforms and parameters measured by the patient monitor. To connect the patient monitor to a VGA monitor, follow the steps below:

1. Place the VGA monitor no closer than 1.5m from the patient.
2. Power off the patient monitor.
3. Connect the cable of the VGA monitor to the VGA connector on the rear panel of the patient monitor.
4. Power on the VGA monitor and then the patient monitor.

REPLACING THE FUSE

1. Pull out the fuse socket.
2. Remove the fuse and replace it with a new one.
3. Push the fuse socket back.

POWERING ON THE MONITOR

To power on the monitor:

1. Before using the monitor, carry out a safety inspection as described in 'INSPECTION' later in this manual.
2. Press the power switch; the power indicator illuminates.
3. When the startup screen progress bar reaches 100%, the system displays the main screen.
4. The monitor is ready.

POWERING OFF THE MONITOR

To power off the monitor:

1. Confirm the patient monitoring has finished.
2. Disconnect all cables and sensors from the monitor and the patient.
3. Press the power switch, and the monitor will power off.

2. MENUS

MENU OPERATION

DISPLAYING MENUS

The monitor has four methods to display menus:

1. Press the main menu button on the front panel.
2. Press the alarm button on the front panel.
3. Pressing the freeze button on the front panel.
4. Select a parameter/channel title to open its corresponding menu.

BROWSE MENU

The inverse black button in the menu bar is the button selected by the cursor. Select the desired button to display the corresponding submenu or dialogue box, or to carry out the selected function. Refer to the relevant part in this manual for detailed information.

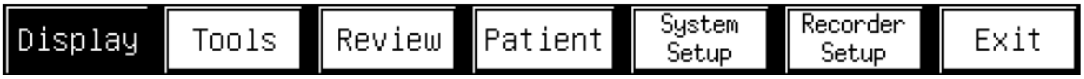
EXIT MENU

The L550 has three methods to exit menus:

1. Select Exit in the right-end of menu bar to return to the previous menu.
2. When a menu is displayed, pressing the main menu button on the front panel will close the menu.
3. The monitor automatically exits the menu if there is no operation after a minute.

MAIN MENU

Pressing the *Main Menu* button on the front panel displays the main menu:



Display: Sets the display interface.

Tools: Sets the practical tools.

Review: Checks/reviews the history trend or data.

Patient: Sets the patient's information.

System Setup: Sets the system information.

Recorder Setup: Sets the recorder/ built-in recorder parameters.

DISPLAY

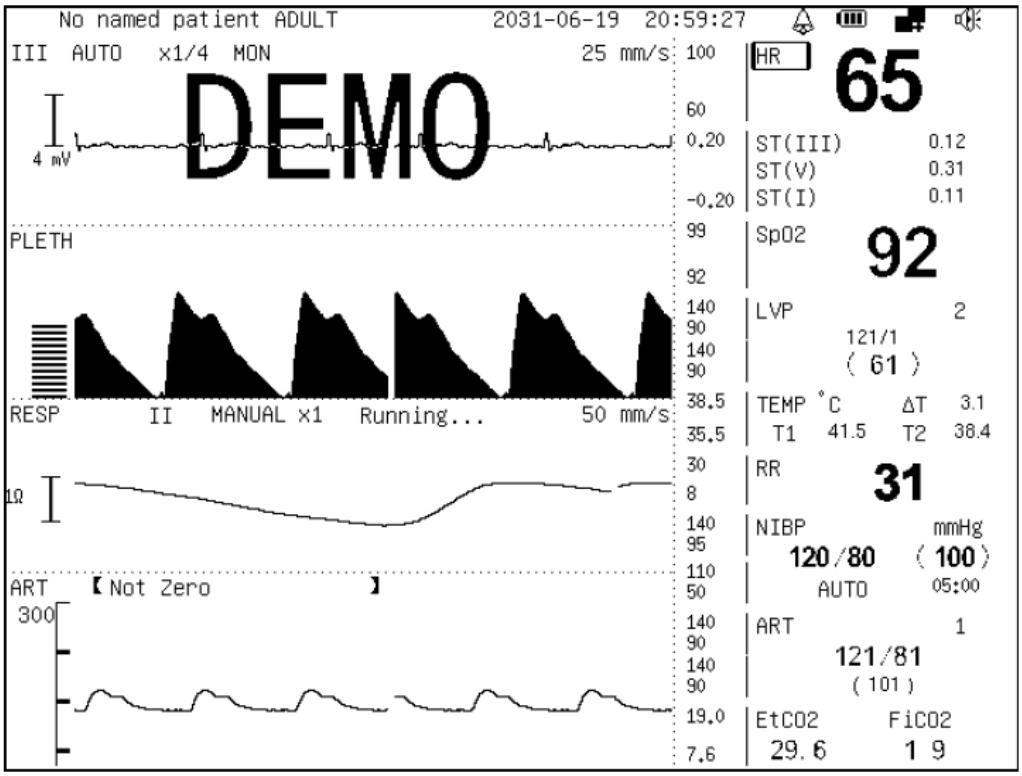
Selecting Display in the *Main Menu* displays the following menu:

FIXED FORMAT

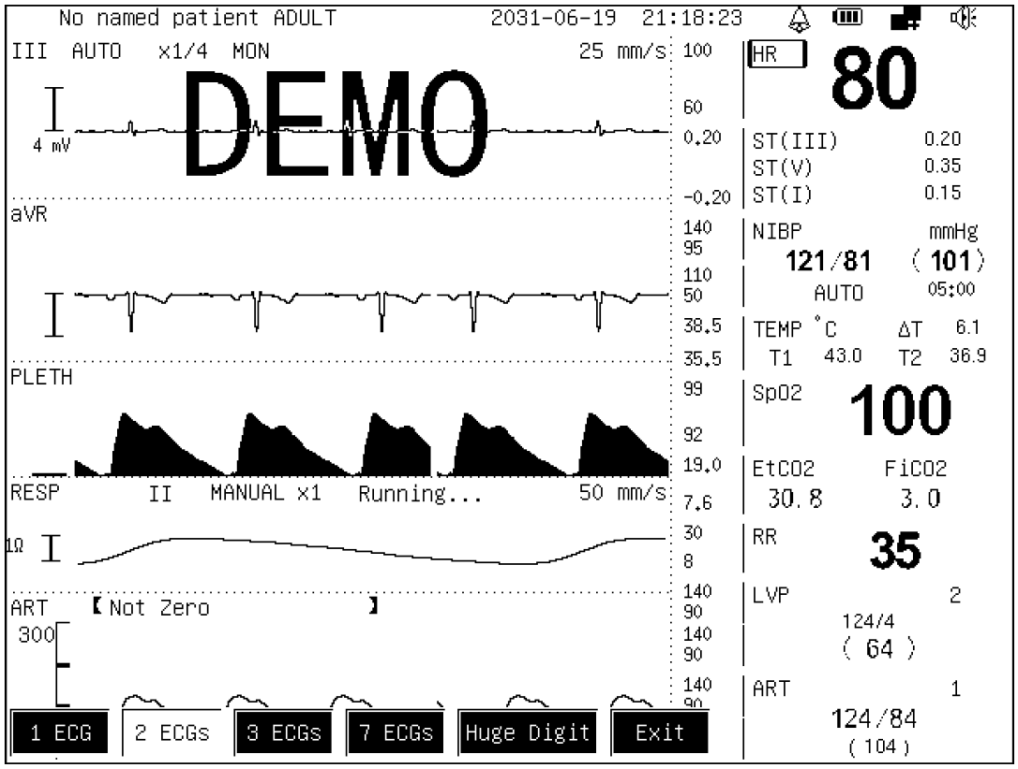
Selecting Fixed Format in the *Display* menu displays the following menu:

In this menu, the user can select display format from five formats. Select an option; the main interface changes format accordingly.

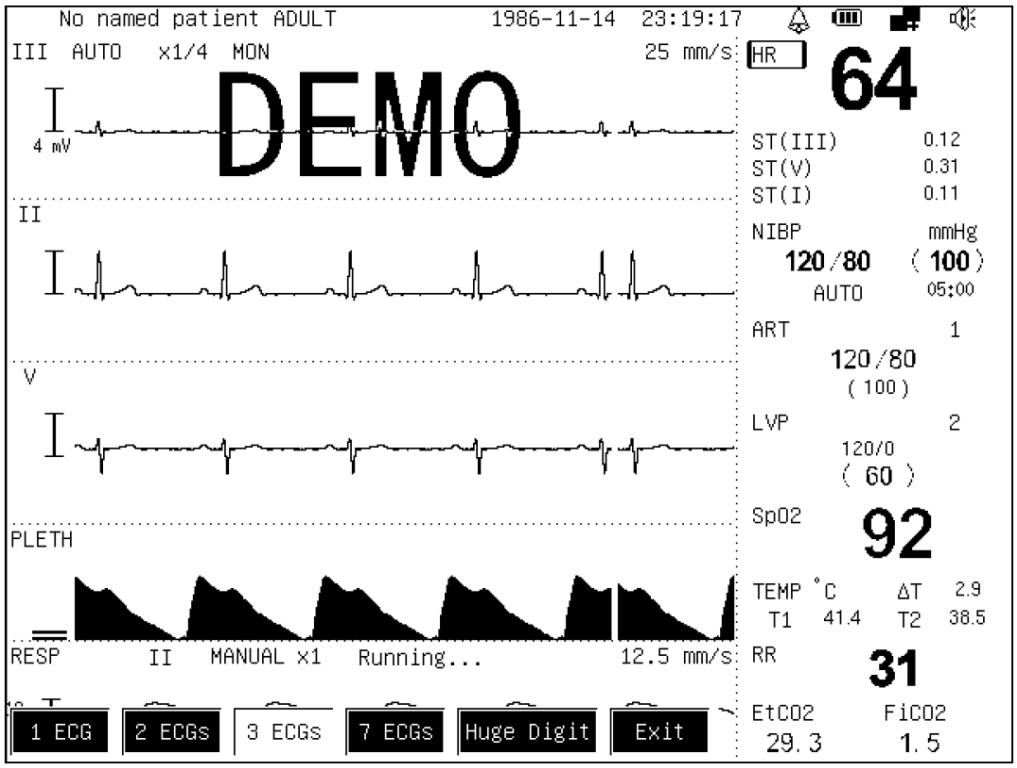
1 ECG: One ECG (main lead) waveform is displayed in the channels area.


No named patient ADULT
2031-06-19 20:59:27
III AUTO x1/4 MON
25 mm/s
DEMO
4 mV
100
60
HR
65
0.20
-0.20
ST(III) 0.12
ST(V) 0.31
ST(I) 0.11
PLETH
99
92
SpO2
92
140
90
LVP 2
121/1
(61)
RESP II MANUAL x1 Running...
50 mm/s
38.5
35.5
TEMP °C ΔT 3.1
T1 41.5 T2 38.4
1Ω
30
8
RR
31
140
95
NIBP mmHg
120/80 (100)
AUTO 05:00
110
50
ART 【Not Zero】
300
ART 1
121/81
(101)
19.0
7.6
EtCO2 FiCO2
29.6 1.9

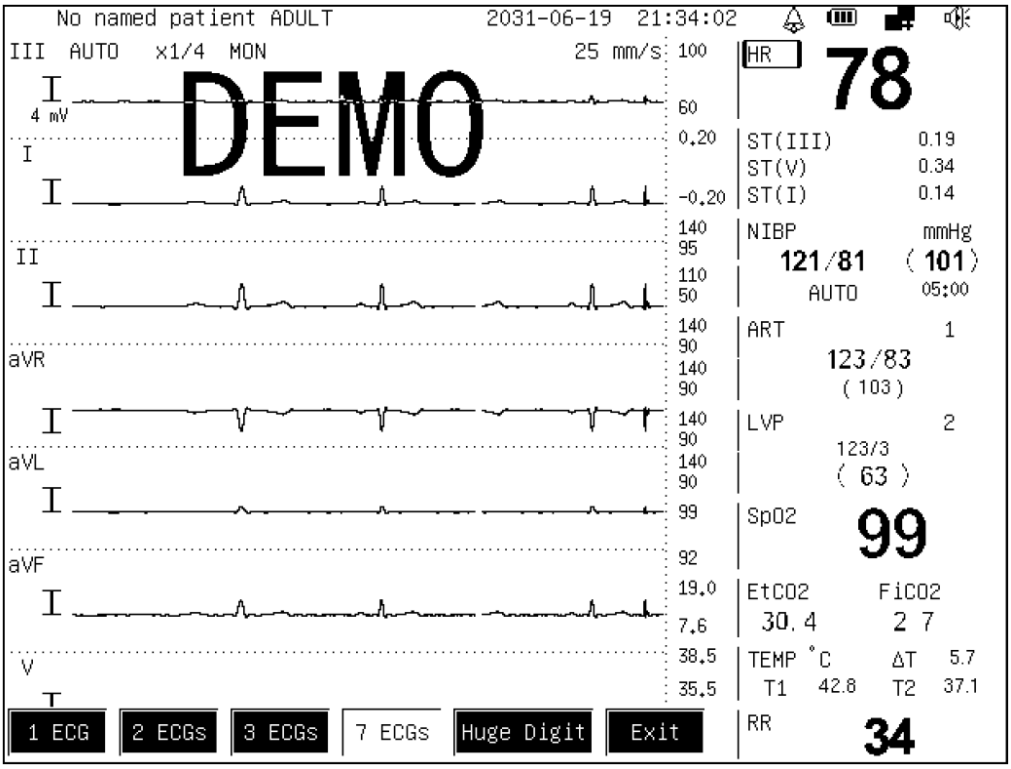
2 ECGs: Two ECG waveforms (main lead and one other lead) are displayed in the channels area.



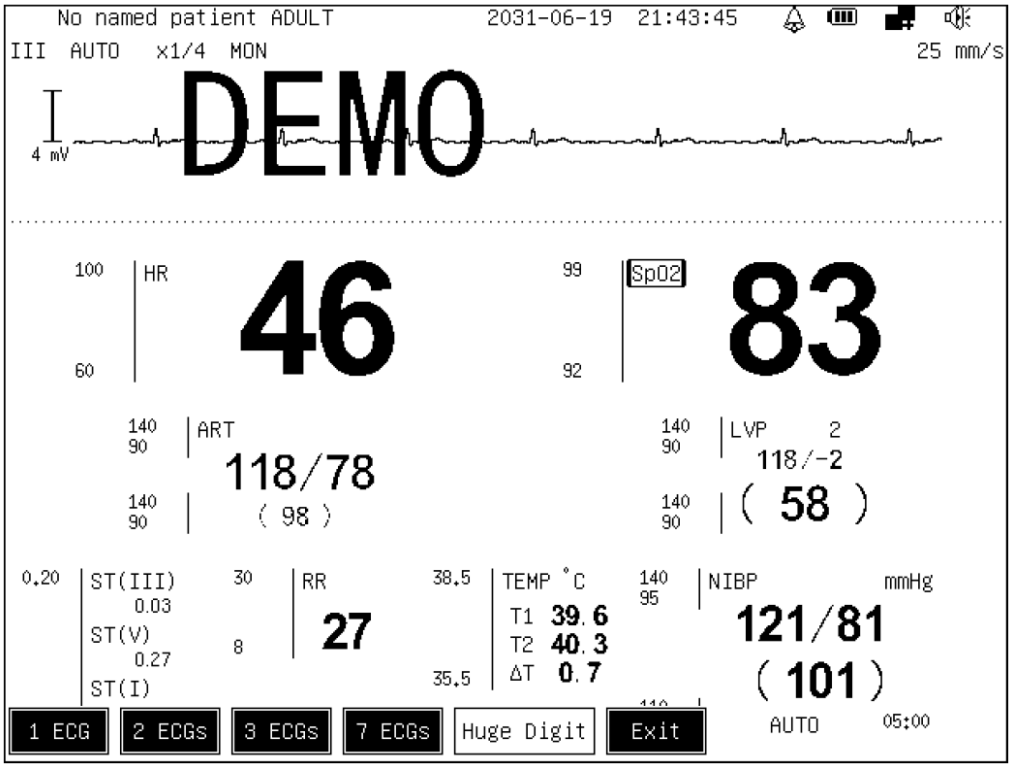
3 ECGs: Three ECG waveforms, a PLETH waveform and a RESP waveform are displayed in the channels area in the default format.



7 ECGs: Seven ECG waveforms (I,II,III,aVR,aVL,aVF and V leads) are displayed in the channels area.



Huge Digit: HR and SpO2 are displayed in large characters, while the main lead ECG waveform is displayed on the top part of the screen.



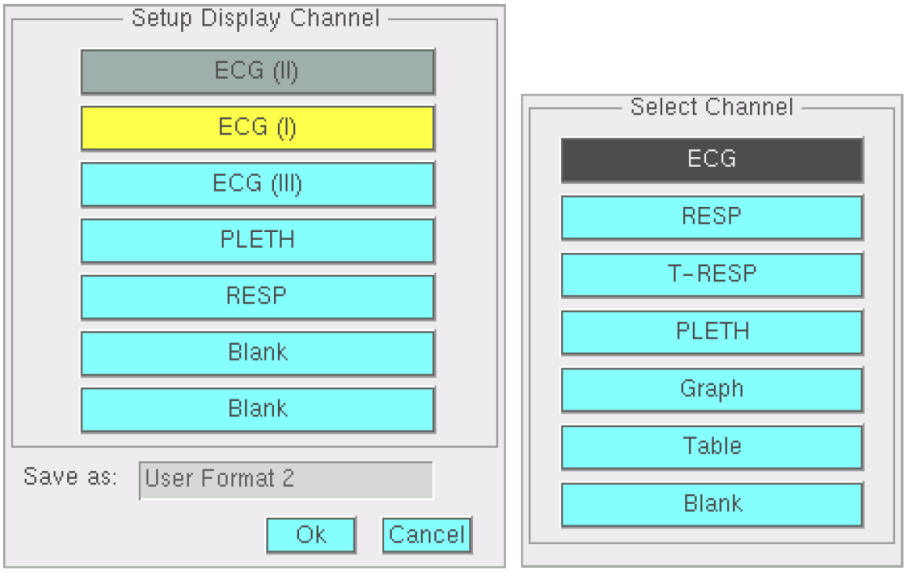
USER FORMAT

Selecting User Format in the *Display* menu displays the following menu:

In the User Format menu, the display format of the main interface can be set. The system supports five user formats. The current display format can be saved as a user format via Format Setup button.

FORMAT SETUP

Selecting Format Setup in the *Display* menu displays the following dialogue box.



The *Setup Display Channel* dialogue box displays the title of the channel currently displayed in the channels area.

Save as:

Not Save or User Format x can be selected. If Not Save is selected, the channels area displays the channels selected in this dialogue box. If User Format x is selected, the channels area displays the channels selected in this dialogue box and the current display format will also be saved as a user format.

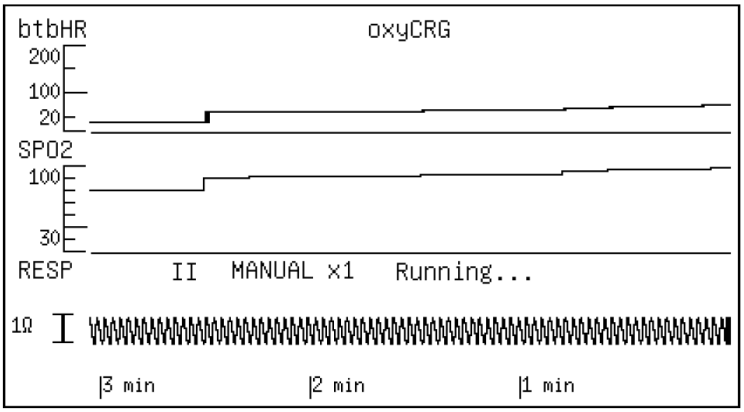
Select a desired channel, the *Select Channel* menu is displayed as shown above right. All channels are listed in this menu. Select the desired channel to add it into the setup display channel dialogue box.

NOTE:

- Two of the same channel cannot be displayed simultaneously.
- If channel is 'Blank', no channel is displayed.
- If ECG is selected, the system matches the relevant ECG lead automatically.

oxyCRG

Selecting oxyCRG in the *Display* menu displays the following oxyCRG graph in the channels area.

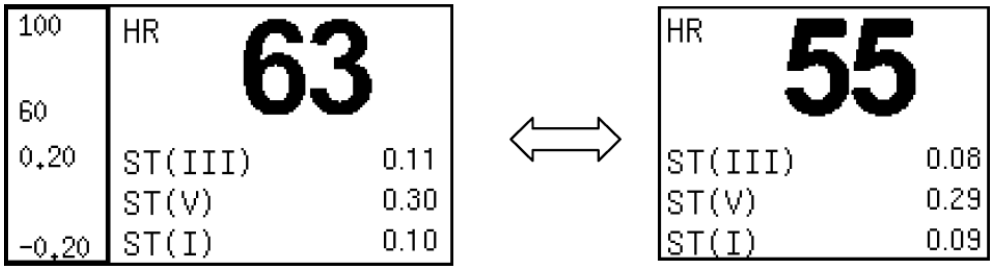


oxyCRG is formed by the patient heart rate, SpO2 and respiration trend graphs. Relevant information is displayed to the right of the RESP title. The time scale (1min, 2min, 3min or 4min) is displayed at the bottom of the RESP trend graph.

oxyCRG only shows the trend graph for the last 4 minutes of monitoring.

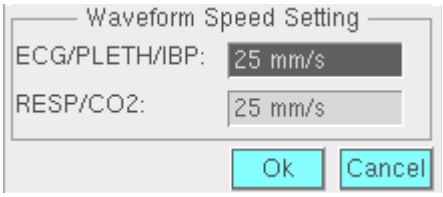
ALARM LIMIT

Select Alarm Limit in the *Display* menu to display/hide the alarm limit in parameters area, as shown below:



WAVEFORM SPEED

Selecting Waveform Speed in the *Display* menu displays the waveform speed setting dialogue box in which the waveform speed of ECG/PLETH/IBP and RESP/CO2 can be adjusted.

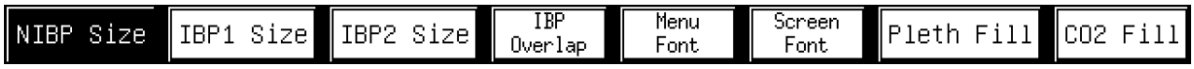


Options: 6.25mm/s, 12.5mm/s, 25mm/s or 50mm/s.

Default waveform speed: 25mm/s.

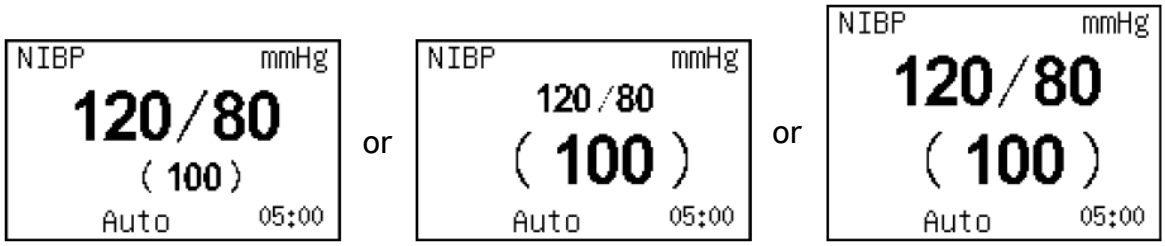
OTHER SETTINGS

Selecting Other Settings in the *Display* menu displays the following menu:



NIBP size

Select NiBP Size in the *Other Settings* menu, to choose between three formats for the NiBP value display, as shown below:

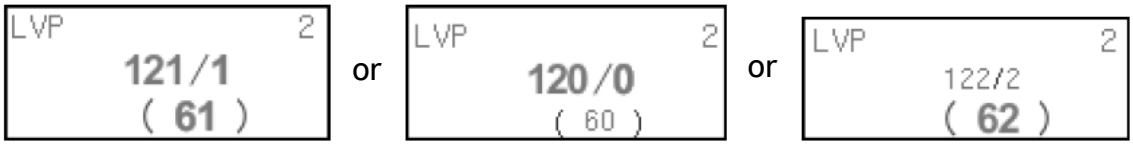


iBP1 Size

Select iBP1 Size in the *Other Settings* menu, the display format of channel 1 iBP value switches among three formats, as shown below:

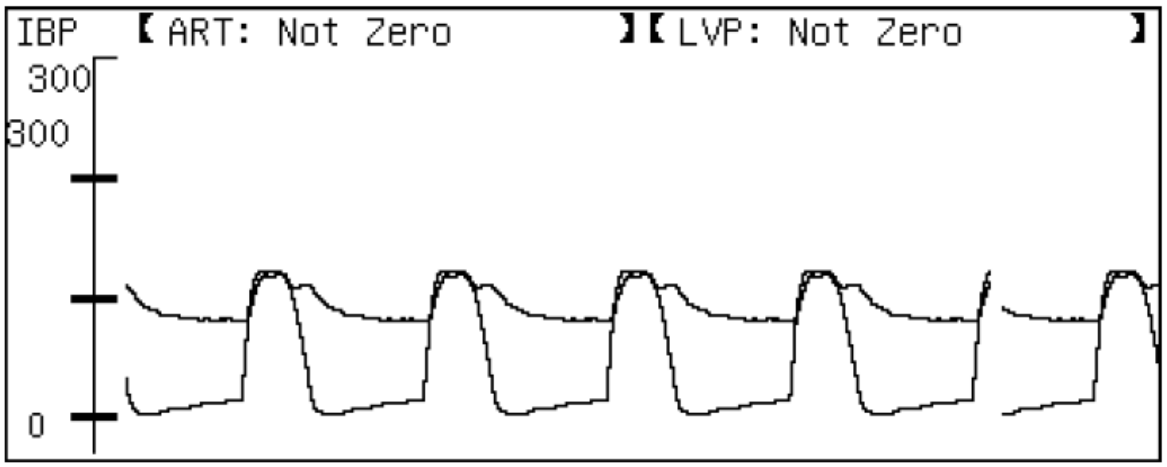
iBP2 Size

Select iBP2 Size in the *Other Settings* menu, the display format of channel 2 IBP value switches among three formats, as shown below:



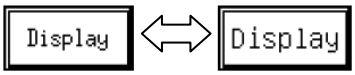
IBP Overlap

Select iBP Overlap in the *Other Settings* menu, the iBP waveforms of two channels are displayed in a channel, as shown below:



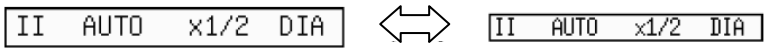
Menu Font

Select Menu Font in the *Other Settings* menu, the menu font switches between large font and small font, as shown below:



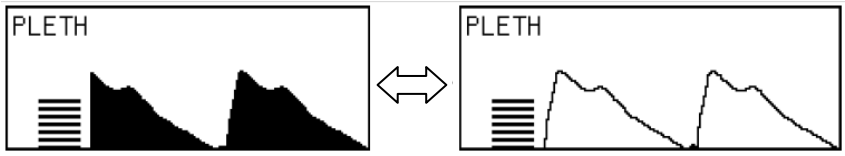
Screen Font

Select Screen Font in the *Other Settings* menu, the screen font switches between large font and small font, as shown below:



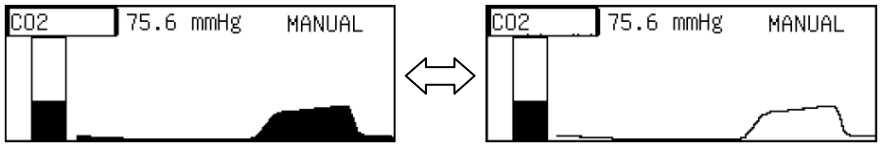
PLETH Fill

Select PLETH Fill in the *Other Settings* menu, the PLETH waveform will be filled or be empty, as shown below:



CO2 Fill

Select CO2 Fill in the *Other Settings* menu, the CO2 waveform will be filled or be blank, as shown below:



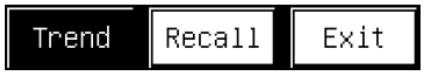
TOOLS

Selecting Tools in the *Main Menu* displays the following menu:

1. Event: Sets the event.
2. Drug Calculator: Calls the drug calculator.
3. Other Patient: Views waveforms and parameter values of another monitor on the same network.
4. Standby: Enters standby mode. In this mode, the monitor shows standby interface instead of the main interface and gives the audible alarms if an alarm occurs. Press the main menu button on the front panel to return to normal mode.

REVIEW

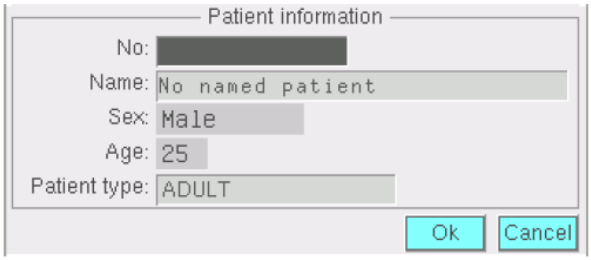
Selecting Review in the *Main Menu* displays the following menu:



- Trend: Reviews/checks the trend data.
- Recall: Recalls the saved waveform.

PATIENT

Selecting Patient in the *Main Menu* opens the following patient information dialogue box:



1. **No**: Patient identification number, set via the soft keyboard.
2. **Name**: Patient name, set via the soft keyboard. If no name is set, 'No named patient' is displayed.
3. **Sex**: Patient gender. Male or Female, while Male is the default.
4. **Age**: Patient age. The default age is 25. Change the value using the rotary controller.
5. **Patient type**: ADULT, PAEDIATRIC or NEONATE. The default setting is ADULT.

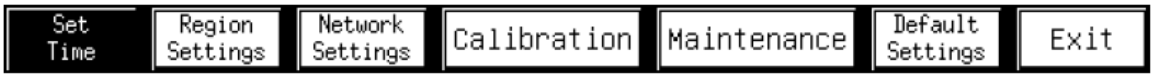
SOFT KEYBOARD

Select the input field to the right of the required text field e.g. 'No:' in the example above, the soft keyboard is displayed, as shown below:

A	Select this button to select upper case letters, lower case letters, numerals and symbols sequentially.
ABCDEFGHIJ	Character field: Press and turn the rotary controller to select the desired character, then click again to add it into the input field.
◀ ▶	Change the characters in the character field a page at a time left or right.
I	Move the cursor in the character field. Select this button then turn the rotary controller to move the cursor forward or backward.
X	Delete the character to the left of the cursor.
Ok	Confirm input.

SYSTEM SETUP

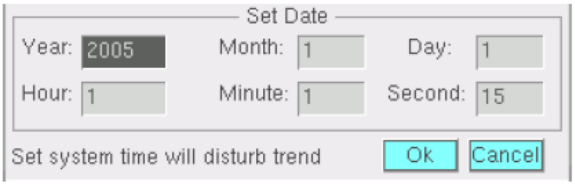
Selecting System Setup in the *Main Menu* displays the following menu:



In this menu, calibration is used by DARAY, while the others are used by the user.

SET TIME

Selecting Set Time in the *System Setup* menu displays the set date dialogue box, as shown below:

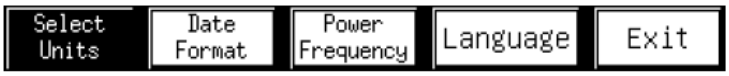


The year, month, day, hour, minute and second of the system time can be set in this dialogue box.

NOTE: Resetting the system time will clear the stored trend data.

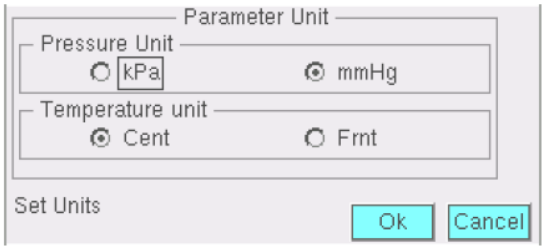
REGION SETTINGS

Selecting Region Settings in the *System Setup* menu displays the following menu:



Select Units

Selecting Select Units in the *Region Settings* menu opens the *Parameter Unit* dialogue box, as shown below:



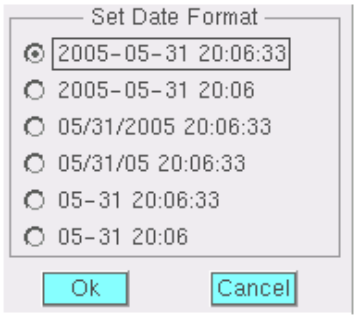
The pressure unit and temperature unit can be set in this dialogue box.

- Pressure unit options: kPa and mmHg
- Temperature unit options: Cent and Frnt

Click OK to confirm the selection. The corresponding value is displayed with the selected unit.

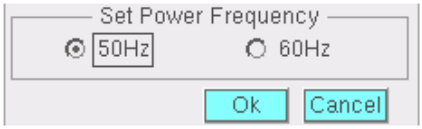
Date Format

Selecting Date Format in the *Region Settings* menu opens the *Set Date Format* dialogue, as shown below:



Power Frequency

Selecting Power Frequency in the *Region Settings* menu opens the *Set Power Frequency* dialogue box as shown below:



Power frequency options: 50Hz or 60Hz

NOTE: Set the correct power frequency to prevent excessive ECG signal noise.

Language

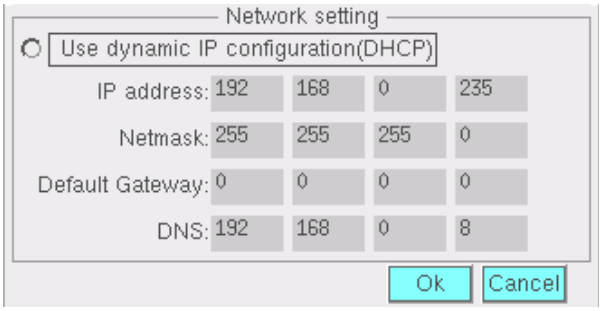
Select Language in the *Region Settings* menu, and the system language changes.

NETWORK SETTINGS

Selecting network settings in the *System Setup* menu displays the following menu:

IP Address

Selecting IP address in the *Network Settings* menu displays the *Network setting* dialogue box to set the IP configuration, as shown below:

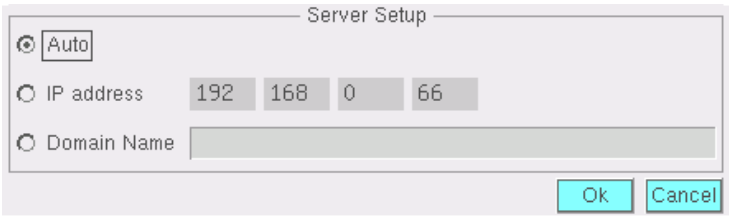


If *Use dynamic IP configuration (DHCP)* is selected, the L550 is issued an IP address automatically when it is turned on to help prevent IP address conflict.

To set the IP address manually, deselect *Use dynamic IP configuration (DHCP)*, and then select the input field to the right of *IP address* to set it manually. Select OK button to confirm the selection.

Server

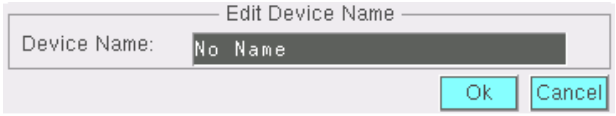
Selecting Server in the *Network Settings* menu displays the server setup dialogue box where the address of the central monitoring system server can be set, as shown below:



- *Auto*: The monitor searches for the server address automatically.
- *IP address*: Input the IP address of the server manually.
- *Domain Name*: Input the domain name of the server via the soft keyboard; e.g. http://xxx.com.

Device Name

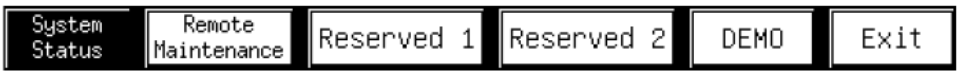
Selecting Device Name in the *Network Settings* menu displays the *Edit device name* dialogue box, as shown below:



The device name of the L550 can be set in this dialogue box. If the L550 is not assigned a device name, 'No Name' is displayed.

MAINTENANCE

Selecting Maintenance in the *System Setup* menu displays the following menu:



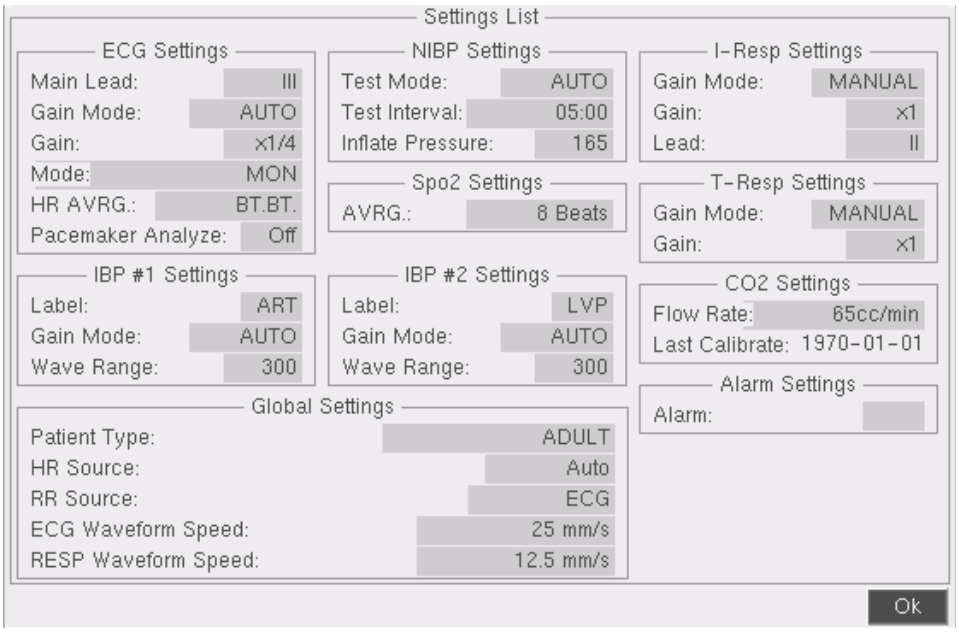
Reserved buttons are for DARAY use only and are not intended for the end-user.

System Status

Selecting System Status in the *Maintenance* menu displays the following menu to view and check the relevant information of the system:

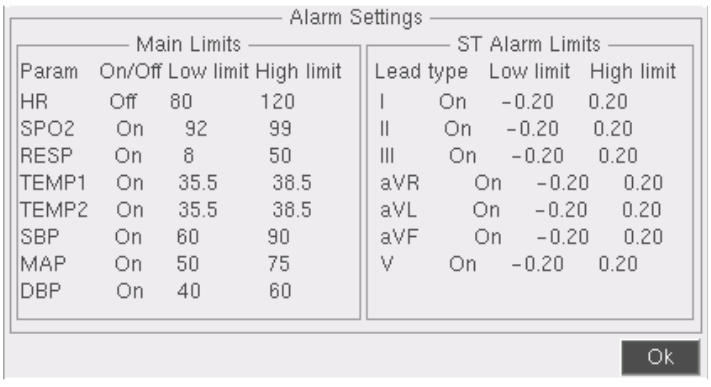
Main Settings

Selecting Main Settings in the *System Status* menu displays the following settings list information box where all the parameters and patient settings can be viewed:



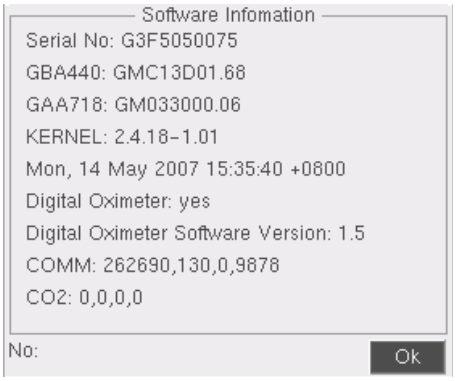
Alarm Limits

Selecting Alarm Limits in the *System Status* menu displays the following alarm settings information box where the upper alarm limits, lower alarm limits and alarm switches of all the parameters can be viewed and checked.



Software Version

Selecting Software Version in the *System Status* menu displays the following software information box.



Remote Maintenance

WARNING: Remote maintenance must be carried out by DARAY only. If a software upgrade becomes available, DARAY will provide instructions and how to perform the upgrade.

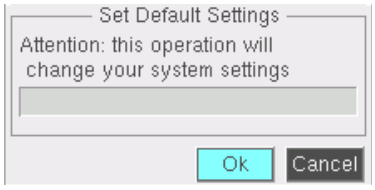
Demo

Select DEMO in the *Maintenance* menu, the system enters demo mode. In this mode, the L550 simulates the waveforms and parameters in actual use, and displays word 'DEMO' on the screen. The purpose of the demonstration mode is to demonstrate the performance of the monitor, and for training purposes.

WARNING: In clinical applications, this function should not be used because the DEMO status can mislead the medical staff to treat the DEMO waveforms and parameters as the actual data of the patient. This may result in serious injury to the patient, or a delay of treatment or improper treatment.

DEFAULT SETTINGS

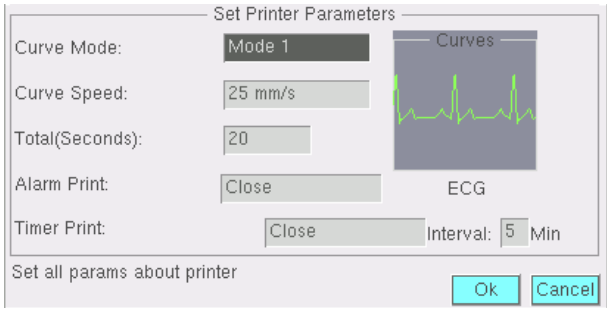
Selecting Default Settings in the *System Setup* menu displays the set default settings dialogue box, as shown below:



Select OK, the system reverts to the default settings.

RECORDER SETUP

Selecting recorder setup in the Main Menu displays the set recorder parameters dialogue box, as shown below:



- **Curve Mode**: Printing mode of the curve.
    - *Mode 1*: Print an electrocardiogram waveform, namely the main lead ECG waveform.
    - *Mode 2*: Print two waveforms, namely the main lead ECG and PLETH waveforms.
- **Curve speed**: Printing speed. Options: 12.5mm/s and 25mm/s.
- **Total (Seconds)**: waveform printing time. It can be selected in the range from 5 to 30 seconds.
- **Alarm print**: Alarm printing switch.
    - *Open*: The recorder automatically prints all the measured parameter values when the physiological alarms occur.
    - *Close*: The recorder doesn't print any measured parameter value when the physiological alarms occur.
- **Timer Print**: Timer printing switch.
    - *Open*: The recorder automatically prints all the measured parameter values at the preset interval.
    - *Close*: The recorder doesn't print any measured parameter value automatically.
- **Interval**: The interval time between two printings, which can be selected in the range from 1 to 60 minutes.

The default setting for *Alarm Print* and *Timer Print* is 'Close'.

3. ALARMS

The L550 gives audible and visual alarms to indicate to medical staff when a vital sign of a patient is displayed abnormal, or a mechanical or electrical problem occurs with the monitor.

ALARM CATEGORIES

Alarms are divided into two categories:

Physiological alarms

A physiological alarm either indicates that a monitored physiological parameter is out of specified limit or indicates an abnormal patient condition.

Prompt information

The L550 also displays information related to the system. For example, if a parameter module is turned on but the required leads or sensor are not connected, the monitor will prompt accordingly, such as '*Lead Off*' in the ECG and RESP channels, '*Sensor Off*' in the PLETH channel, or '*No Cuff*' under the NIBP parameter, etc. Prompt information is usually displayed in the channels area, but prompt information relating to NIBP is displayed under the NIBP value in the parameters area.

ALARM MODES

When an alarm occurs, the monitor implements the following audible or visual indications to attract the user’s attention

Visual alarms

When a measured physiological parameter's value exceeds its preset alarm limit, the alarm indicator on the front of the monitor flashes red.

Audible alarms

When a measured physiological parameter's value exceeds its preset alarm limit, the monitor will sound a triple-beep tone every three seconds to prompt users.

Character flashes

When a measured physiological parameter's value exceeds the preset alarm limit, or a lead or sensor is disconnected from the monitor, this associated parameter value in the parameters area or the prompt information in the corresponding channel flashes once a second.

ALARM SETTINGS

SETTING ALARM VIA ALARM button

Press the Alarm button on the front panel of the L550, the following alarm menu is displayed:

Alarm On/Off

Selecting Alarm On/Off in the *Alarm* menu enables or disables physiological alarms.

Alarms enabled icon

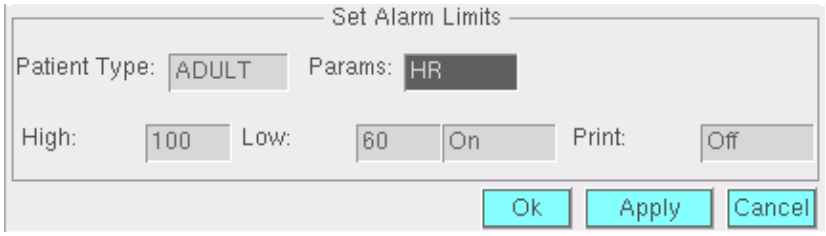
is displayed in the status bar. The physiological alarms are turned on and the monitor alarms when a measured parameter value exceeds its preset alarm limit.

Alarms disabled icon

is displayed in the status bar. The physiological alarms are turned off and the monitor does not produce alarms even if the measured parameter value exceeds its preset alarm limit.

Alarm Settings

Selecting Alarm Aettings in the *Alarm* menu, displays the following set alarm limits dialogue box:



The upper alarm limit, lower alarm limit, alarm switch and alarm printing switch of each parameter in different patient type can be set in this dialogue box.

- **Patient Type**: ADULT, PAEDIATRIC or NEONATE.
- **Params**: HR, SpO2, NIBP, RESP, TEMP, ST, IBP1, IBP2, FiCO2 or EtCO2.
- **High**: Upper alarm limit.
- **Low**: Lower alarm limit.
- The input field to the right of the lower alarm limit value enables or disables the alarm of this parameter but doesn't affect the alarms of other parameters.

  On: The alarm of this parameter is turned on and the monitor alarms when this measured parameter value exceeds its preset alarm limit.

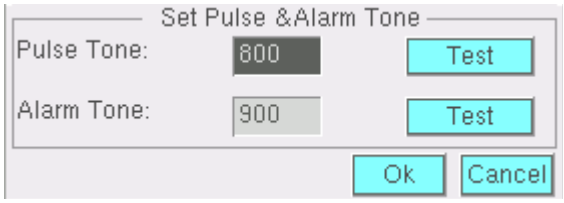
  Off: The ✖ icon is displayed on the left of this parameter's title. The alarm of this parameter is turned off and the alarms are not generated when the measured value of this parameter exceeds its preset alarm limit.
- Print: Enables or disables alarm printing of this parameter.

On: Alarm printing of this parameter is turned on and the recorder prints all the measured parameter values automatically when this parameter's alarm occurs.

Off: Alarm printing of this parameter is turned off and the recorder doesn't print any measured parameter values when this parameter's alarm occurs.

Alarm Tone

Selecting Alarm Tone in the *Alarm* menu displays the following *Set Pulse & Alarm Tone* dialogue box.

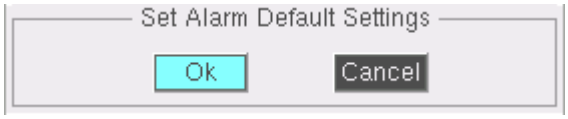


The pulse tone and the alarm tone can be set separately in this dialogue box. Enter the tone value and select Test; the monitor sounds the corresponding test tone.

Select Ok to confirm the setting.

Default Limit

Selecting Default Limit in the *Alarm* menu displays the following *Set Alarm Default Settings* dialogue box:

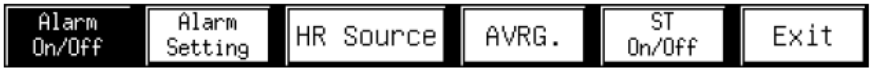


Selecting OK in this dialogue box sets all the alarm limits to their default values and enables the alarm of each parameter, but doesn't change the status of the physiological alarms.

SETTING ALARM VIA PARAMETER TITLE

Selecting a parameter title displays the corresponding menu. Although the menu of each parameter is different, all the menus have the same alarm on/off and alarm settings buttons to set the alarm limits separately.

For example, select the HR title in the parameters area to display the HR menu, as shown below:

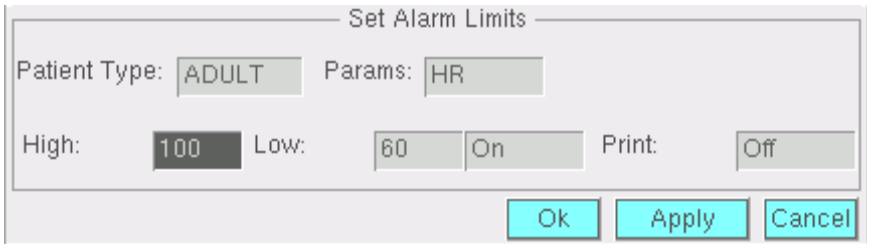


• Alarm On/Off: Enables or disables the HR alarm.

Alarm enabled: The HR alarm is turned on and the monitor alarms when the measured HR value exceeds its preset alarm limit.

Alarm disabled: The ✖ icon is displayed to the left of the HR title. The HR alarm is turned off and the monitor does not generate alarms when the measured HR value exceeds its preset alarm limit.

- Alarm Setting: Selecting this button opens the following *Set Alarm Limits* dialogue box:



Patient type and **Params** cannot be changed in this dialogue box.

- **High**: Upper alarm limit. Determines the upper HR alarm limit.
- **Low**: Lower alarm limit. Determines the lower HR alarm limit.
- The input field on the right of the lower alarm limit: Enables or disables the HR alarm.

  On: The HR alarm is turned on, and the monitor alarms when the measured HR value exceeds its preset alarm limit.

  Off: The ✖ icon is displayed on left of the HR title. The HR alarm is turned off and the monitor does not generate alarms when the measured HR value exceeds its preset alarm limit.
- **Print**: Enables or disables the HR alarm printing.

  On: The HR alarm printing is turned on, and the recorder prints all the measured parameter values automatically when a HR alarm occurs.

  Off: The HR alarm printing is turned off, and the recorder doesn't print the measured parameter values when a HR alarm occurs.

WHEN AN ALARM OCCURS

When an alarm occurs, refer to the following steps and take proper action.

1. Check the patient's condition.
2. Identify the alarming parameter and the alarm category.
3. Identify the cause of the alarm.
4. Take action to remedy the alarm cause.
5. Check if the alarm is cleared.

WARNING: When an alarm occurs, always check the patient's condition first.

4. WAVEFORM FREEZING AND RECALLING

The user can freeze the monitored waveforms of a patient as required and additionally view the last 15 seconds of waveforms to assist observation.

The freezing and recalling function of the monitor has the following features:

- When the monitor enters freeze mode, all other menus are automatically closed.
- The system freezes all waveforms displayed in the channels area.
- Only the last 8 saved frozen waveforms can be recalled.

FREEZE MODE

FREZE WAVEFORMS

By pressing the Freeze button on the front panel, all the waveforms displayed on the screen are frozen and the system quits all menus (if any are displayed) and displays the following menu:

Last Page, Next Page: Turns the waveforms forward or backward to view the waveforms of 15 seconds •before freezing.

Save: Select this button to save the frozen waveforms. If the waveforms are successfully saved, the •following menu is displayed.

EXIT FREEZE MODE

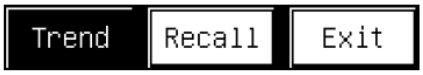
To exit freeze mode,

- Select Exit in the Freeze menu
- Press the Freeze button or the Main menu button on the front panel.

After exiting freeze mode, all frozen waveforms on the screen are cleared and real-time waveforms are displayed.

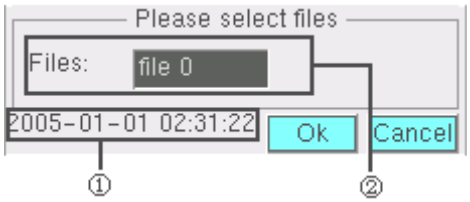
WAVEFORM RECALLING

Select Review in the *Main Menu*



Select Recall from the *Review* menu. The last waveforms saved and the following menu are displayed on the screen.

- Select File: Selecting this button displays the following *Please select files* dialogue box:



① The start time of the selected file

② The selectable saved files

Move the cursor to position 2 and select the desired file by turning the rotary controller, then select OK, the corresponding waveforms is displayed on the screen.

- Last Page/Next Page: Shift the waveforms forward or backward to view waveforms in blocks of 15 seconds.
- Exit: Select Exit from the Recall menu or press the *Main Menu* button on the front panel to exit Recall mode.

5. PRINTING (RECORDING)

The recorder is an optional feature. If the L550 has an integrated recorder, there is a recorder setup button in the Main Menu for changing recorder settings.

Recorder specifications

- Prints patient information and parameters.
- Prints a maximum of two waveforms.
- Optional printing rates: 25mm/s and 50mm/s.
- Multiple printing types are supported.

PRINTING TYPES

The L550 supports the following types of printing:

- Real-time printing.
- Timer printing.
- Alarm printing.
- Trend graph printing.

REAL-TIME PRINTING

Pressing the print button on the front panel starts real-time printing. The current waveforms are printed until the preset printing time is over or the print button is pressed again at which point the measured parameter values are printed.

TIMER PRINTING

The L550 starts printing all measured parameter values at the preset interval.

ALARM PRINTING

The L550 starts printing all the measured parameter values when the monitor generates physiological alarms.

NOTE:

To allow the alarm printing of a parameter, the alarm print in set recorder parameters dialogue box, physiological alarms, and alarm and alarm printing of this parameter should be enabled.

In normal working status, the recorder cannot be configured.

If the interval arrives but the recorder is working, the monitor skips the parameter printing this time.

WAVEFORM AND PARAMETER PRINTING

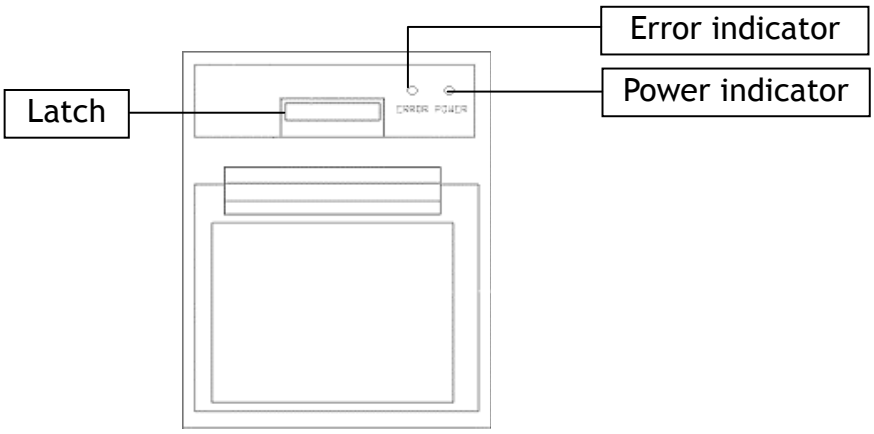
Press the print button on the front panel, the recorder prints waveforms until the preset printing time is over, then prints all the parameter values measured at this moment, and then stops.

Press the print button to interrupt and stop printing.

INSTALLING RECORDER PAPER

The recorder used on the L550 is a special thermal recorder that is installed on the

side panel, as shown.



If the recorder is installed correctly, only the power indicator lights on. If the error indicator light is on, it means that the recorder is out of paper or the paper has not been installed properly. Do not use the print at this time, or it may damage the recorder. Follow the procedure below to install the recorder paper:

1. Press the latch above the paper compartment door to open the door.
2. The recorder paper is a single side thermal paper. The smoother side that has the temperature sensitive coating on it should be installed facing up.
3. Pull the end of the paper out of the compartment and close the recorder door. If the error indicator light goes out, the recorder paper has been installed properly; if not, repeat the procedure specified above.

NOTE:

- Use the specified recorder paper only. Other recorder paper may cause the recorder to print with poor quality, function improperly or not at all, or damage to the thermal print head.
- If the recorder is not properly connected, the message '*Recorder is not probed correctly!*' is displayed in the lower left of the set recorder parameters dialogue box.
- Do not open the recorder door when the recorder is printing.
- Do not install any other type of recorder in the L550, otherwise the L550 may be permanently damaged.

6. TRENDS AND EVENTS

TRENDS

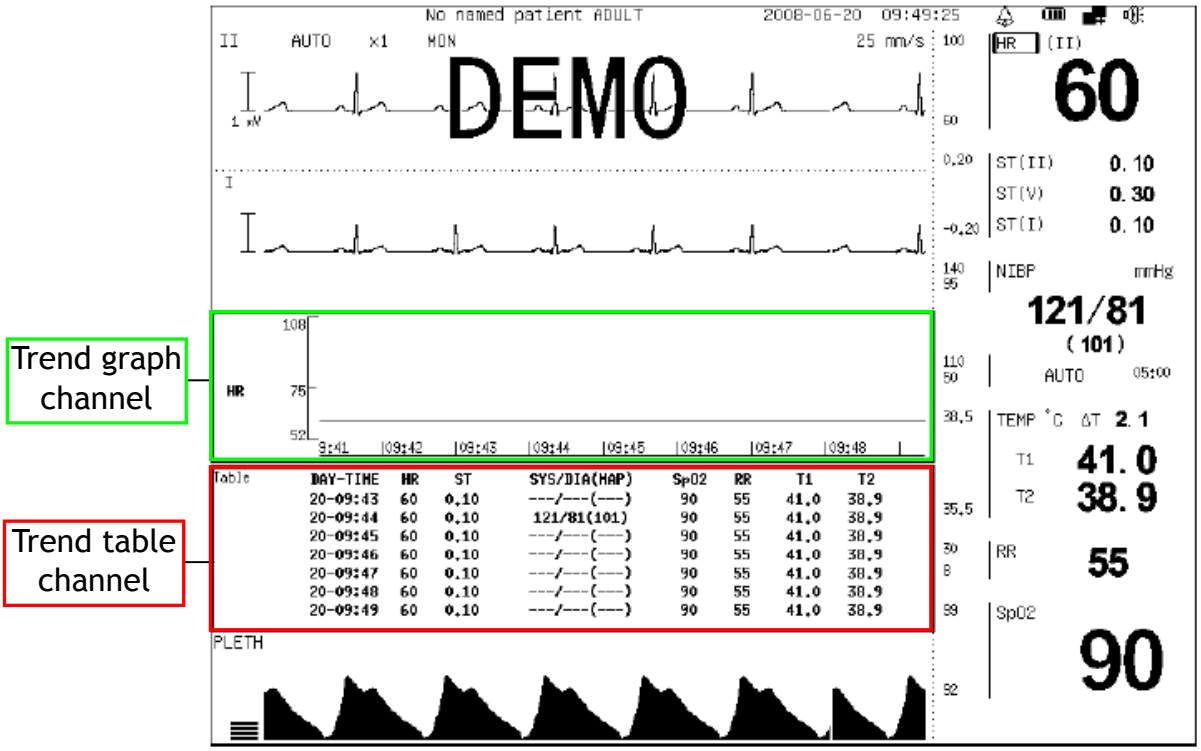
Trend data is patient data collected over time. The trend function displays the patient's status graph/trend graph and status table/trend table according to the trend data and can be used for reviewing the waveforms and parameter values at a particular time to help assess the patient status appropriately. If the L550 is equipped with a recorder, the trend graph can be printed.

The L550 has two methods to display trend graph/table, one is to display it in the channel area, and the other is to display it in the trend window.

TREND CHANNELS

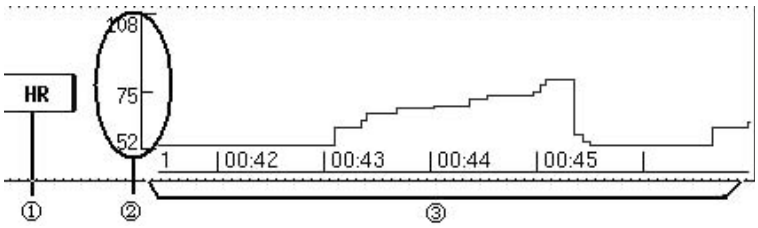
The trend graph/table can be displayed in the channel area, so that the waveforms, measured parameter values and their trend can be viewed at the same time. The trend graph/table channel displays the latest real-time trend data distribution, and the parameters can be selected. Navigate to the required time and adjust the time zoom spans.

Press the *Main Menu* button, select Display, and then select Format Setup to display the *Setup Display Channel* dialogue box. In this dialogue box, select *Graph* or *Table*, then select OK, the trend graph or table is displayed in the channels area, as shown below:



TREND GRAPH CHANNEL

Distribution



① **Parameter title**: Select this title to enter the trend graph channel menu.

② **Measurement scale**: Mark the value scale on the trend graph.

③ **Trend graph area**: The trend graph is displayed in the upper part, while the timescale in the lower.

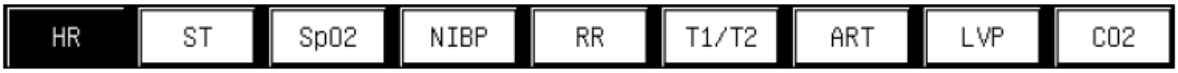
The trend graph for the previous period is displayed in this area. When data no longer fits on one screen, the graph scrolls left automatically. Select Last Page to review the previous trend graph, and Next Page to review the next. Graph colour depends on the parameter. When the parameter value is void, it is grey.

Menu

Selecting the parameter title in the trend graph channel displays the following trend graph channel menu.

Select Param

- Selecting Select Param displays the following menu: Select the desired parameter in this menu, the corresponding trend graph is displayed in the trend graph area.



- Last Page and Next Page: Move the trend graph backwards or forwards.
- Selecting Step displays the following menu: The graph is compressed and the new graph is added according to the step value selected.

- Selecting Range displays the following menu:

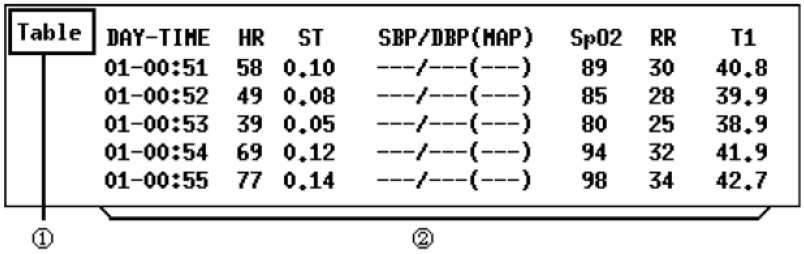
The upper limit/lower limit range of the trend graph is set in this menu. Values exceeding the limit are void.

- ALARMLIMIT: Take the default alarm limits as the range. It is the default.
- MAXRANGE: Take the default maximum and minimum values as the range.
- MANUALADJUST: Adjust the range using the rotary controller, but is limited by

the maximum range.

TREND TABLE CHANNEL

Distribution



① Table title: Select this title to enter the trend table channel menu.

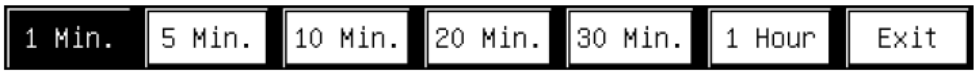
② Data area: Normally, the trend data from the current period is displayed in this area. When data no longer fits on one screen, it scrolls up automatically.

The Last Page, Line Up, Line Down and Next Page buttons can be used to review the trend data of the time concerned.

Menu

Selecting the table title displays the following trend table channel menu.

- Line Up, Line Down, Last Page and Next Page: Navigate through trend data.
- Step: Selecting *Step* displays the following menu: The data is compressed and new data is added according to the step selected.

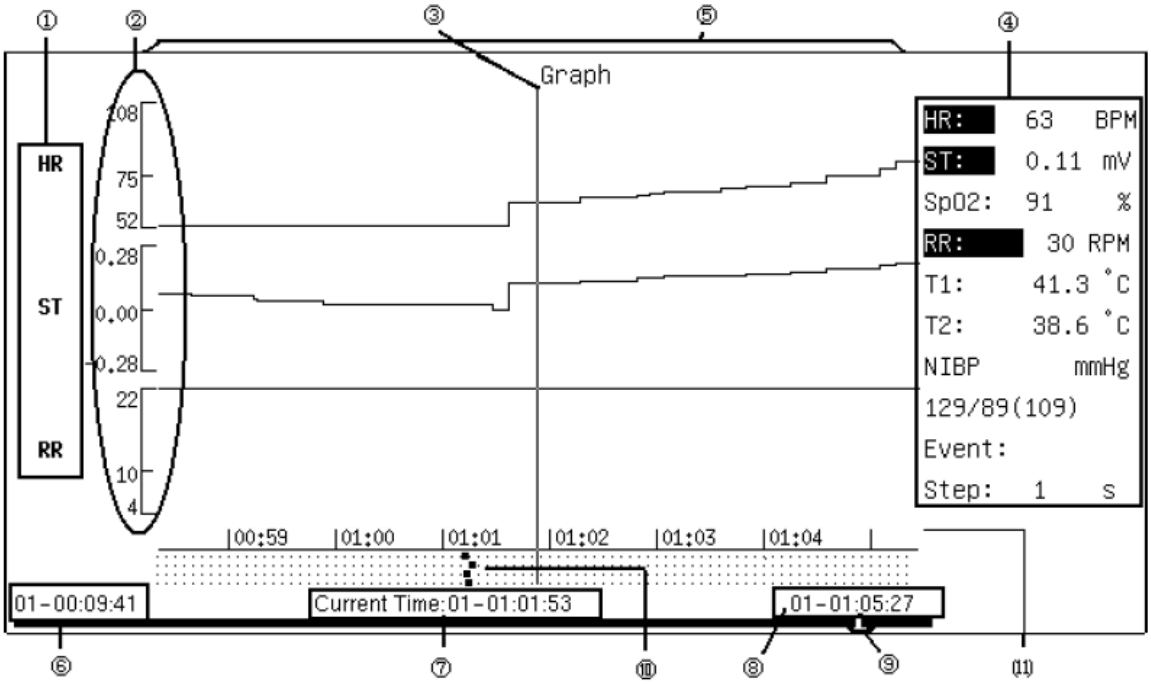


TREND WINDOWS

Select Review in the *Main Menu* followed by selecting trend, the trend graph window is displayed. It can be changed to trend table window via the table button in the displayed menu.

TREND GRAPH WINDOW

Distribution



① **Parameter mark**: The corresponding parameters of the three graphs displayed in the trend graphs area.

② **Scale**: Trend graph scale.

③ **Cursor line**: Move the cursor line using the cursor button.

④ **Parameters table**: The parameter values at the current time are displayed in this table. The inverse black text is the selected parameter, and below the list, event and step are displayed. If there is a recorded event at the current time, the event number is displayed to the right of *Event*. The current step is displayed to the right of *Step*.

⑤ **Trend graphs area**: Displays the trend graph of the selected time quantum. The graph colour is determined by the parameter. When the parameter value is void, its graph is grey.

⑥ **Trend data start time**: The time that the monitor starts to record the trend data.

⑦ **Current time**: The corresponding time of the cursor position.

⑧ **Trend data end time**: The time that the monitor stops recording the trend data.

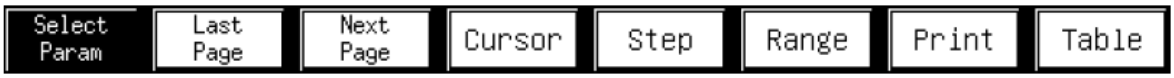
⑨ The mark of the current time in the trend data record time: Marks the position of the current time in the whole trend data record time with red point.

⑩ Event mark: Marks the event recorded in the current page with point in different colour. Yellow point marks event 1, green point marks event 2, blue point marks event 3 and pink point marks event 4.

⑪ Time scale: Marks the time scale of the current page.

Menu

The trend graph window menu is displayed as shown:



- Select Param: Displays the following menu:

Up to three parameters can be selected in this menu. The selected parameter is displayed with an inverse figure in the parameters table. Selecting a parameter again cancels the selection. Select OK to confirm the selection. The corresponding trend graph is displayed.

- Last Page and Next Page: Navigate through the trend graph backwards or forwards.
- Cursor: Select Cursor and use the rotary control; the cursor moves accordingly and the parameter values and events are displayed in the parameters table. Pressing the rotary controller again exits.
- Step: D isplays the following menu:

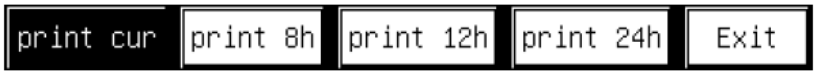
The graph is compressed and a new graph added according to the selection.

- Range: Displays the following menu.

The value range of the trend graph can be set in this menu. When the range is set, the trend data uses it as the upper limit/lower limit. Values exceeding the limit are void.

  - Alarm limit: Use the default alarm limits as the range.
  - Max Range: Take the default maximum and minimum values as the range.
  - Manual Adjust: Adjusts the range by the rotary controller. This range is limited by the Max Range.

- Print: Displays the following menu:



In this menu, you can select to print the trend graph of the current page for the last 8, 12 or24 hours. Only the trend graph displayed on the top part of the trend graphs area is printed.

TREND TABLE WINDOW

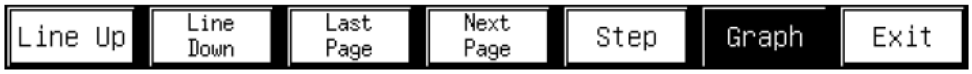
Distribution

Table

DAY-TIME	HR	ST	SpO2
15-01:36	73	0.16	96
15-01:37	57	0.09	89
15-01:38	48	0.04	84
15-01:39	39	0.00	80
15-01:40	71	0.15	95
15-01:41	58	0.09	89
15-01:42	53	0.07	87
15-01:43	44	0.02	82
15-01:44	65	0.12	92
15-01:45	73	0.16	96

The date (day only) and time are displayed in the left column of the trend table. The oldest time is at the top. The interval between times depends on the preset step. In the subsequent columns are the parameter names and values (except NIBP which is the first value in the current step). The symbols '---' mean that the parameter has not been measured at the corresponding time.

Menu

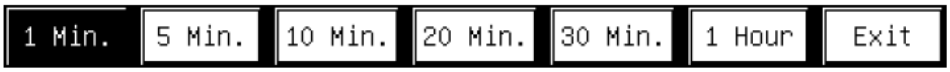


The trend table window menu

- Line Up, Line Down, Last Page and Next Page

  Adjust the time of the trend data forward or backward.

- Step - displays the following menu:



  The data is compressed and the new data is added according to the selected step.

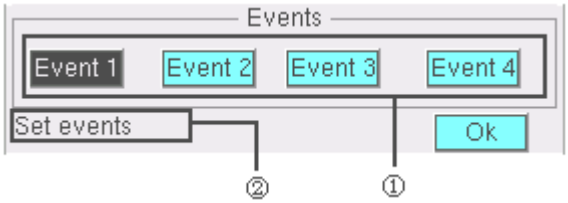
- Graph - Selecting ‘graph’ enters the trend graph window.

EVENTS

The L550 provides events to define situations, such as dose taking, injections or therapy, which have influence on patients and parameter monitoring. A mark is displayed on the trend graph window indicating the time the mark was initiated in relation to the event it represents.

RECORD EVENTS

Selecting Event in the *Tools* menu displays the *Events* dialogue box:



① The events to be recorded.

② Prompt information.

This dialogue box allows the user to mark four different events.

Select *Event 1*, *Event 2*, *Event 3* or *Event 4* and the L550 will record the corresponding events.

For example, if an injection is defined as Event 1, on taking the injection, select Event 1 , the L550 will record the current time and display prompt information '*Set event 1 OK*' at the bottom left of the dialogue box.

BROWSE EVENTS

Beneath the time scale on the trend graph there is an event point with different colours to mark events. Yellow marks *Event 1*, green marks *Event 2*, blue marks *Event 3* and pink point marks *Event 4*. The Last page, Next page and cursor buttons can be used for reviewing the time and parameter values when an event happens.

7. DRUG CALCULATOR

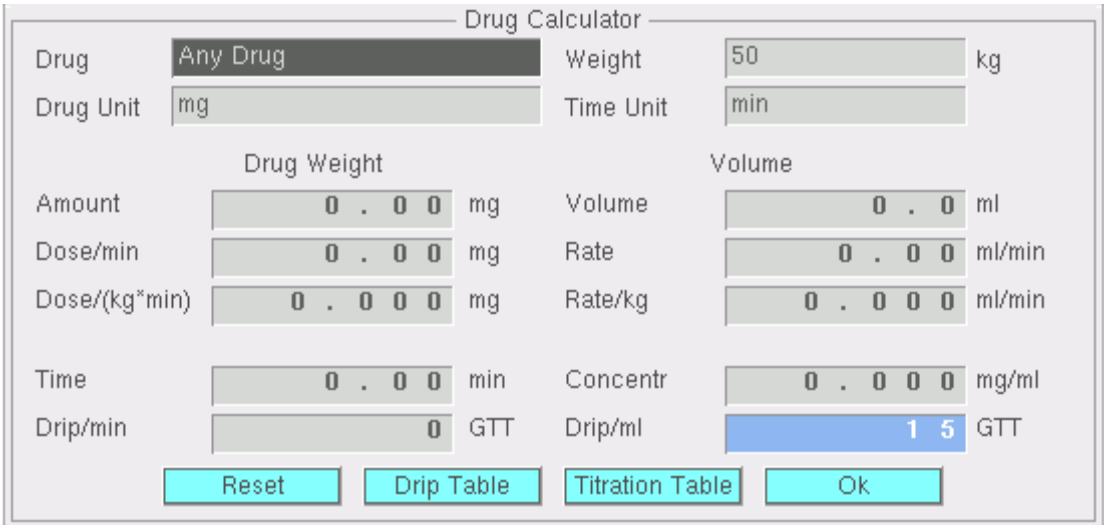
The drug mixture used for intravenous transfusion involves such information as drug dosage, infusion speed, amount, volume, and concentration. The drug calculator can calculate the unknown value via the known items to help you to control the drug infusion.

WARNING:

- Before using any drug, check whether the correct calculation unit or patient weight has been selected. If there are any, consult the dispensary in your hospital.
- It must be the doctor that determines the drug and its dosage. The drug calculator calculates dosage based on the values entered and cannot verify the validity of the calculated data.

ENTER DRUG CALCULATOR

Select Tools in the *Main Menu*, and then select Drug Calculator. The following drug calculator window is diplayed:



UNITS

Drug unit

When *Drug* is set to 'Any Drug', *Drug Unit* can be se to: g, mg, mcg, unit, k unit, m unit or mEq. When *Drug* is specified, *Drug Unit* is set by the drug calculator automatically, and the user cannot modify it. When the Drug Unit is selected, the units relating to the weight in the drug calculator, drip table and titration table change correspondingly.

Time unit

Options: min (minute) or hr (hour). When the Time Unit is selected, the units relating to the time in the drug calculator, drip table and titration table change correspondingly.

TERMINOLOGY

Amount: The total amount of the drug used within certain time.

Volume: The volume of the mixture is formed by drug dilutes and drugs.

Dose/min or **Dose/hr**: The drug quantity injected per minute or per hour.

Dose/(kg*min) or **Dose/(kg*hr)**: The drug quantity injected into 1kg of patient weight per minute or per hour.

Dose/(kg*min) × Weight = Dose/min

Dose/(kg*hr) × Weight = Dose/hr

Rate: The volume of the mixture injected in a minute or an hour. The unit is ml/min or ml/hr.

Rate/kg: The volume of the mixture injected into 1kg of patient weight per minute or per hour. The unit is ml/min or ml/hr.

Rate/kg × Weight = Rate

Time: The consumed time of drug transfusion. The unit is min or hr.

Concentration: The concentration of the mixture formed by the drug dilutes and drug.

Concentration = Amount/Volume

Drip/min (Drip/hr): The gutta of the mixture transfused per minute or per hour.

Drip/ml: The volume of each gutta dropped from the transfusion device. The unit is GTT.

DRUG CALCULATOR

NUMERIC INPUT BLOCK

- The number is input according to the digit. When entering the numeric input block, the numeric input block selects the first digit to the left, turn the rotary controller, the numeric input block selects each digit consecutively from left to right, when it reaches the last, it jumps to the next input block.
- The selection range for each digit is 0~9.
- When the digit is greater than the display value, it displays '---.—', and when it less than the display value, it displays 0.00.
- When it cannot display all digits, the value is rounded off.

CALCULATION FORMULA

- The relational formula of the drug weight Amount = Dose/min × Time

  Dose/min = Dose/(kg*min) × Weight
- The relational formula of liquid volume

  Volume = Rate × Time

  Rate = Rate/kg × Weight
- Concentration = Amount/Volume

KNOWN ITEM AND CALCULATION RESULTS

- *Amount*, *Dose/min*, *Dose/(kg*min)*, *Volume*, *Rate*, *Rate/kg*, *Time* and *Concentration* can be input as the known items or be output as the calculation results.
- At least three known items should be entered according to the calculation requirements; the drug calculator automatically calculates the item.
- The known item is expressed with digits on a blue background and the calculation result is expressed with digits on a grey background.
- When a known item is entered, the result is displayed in real-time and locked, the user can only modify the known item. Modifying the input item as 0.00 means cancelling this input.
- The reset button restores all the items to the initial status.

CALCULATION FOR ANY DRUG

- When the drug selection is 'Any Drug', the drug calculator only provides the calculation with no application range prompt for the dose, concentration etc.
- Enter *Weight*, *Drug Unit* and *Time Unit*.
- Input the known item, and the drug calculator will calculate relevant item.

CALCULATION FOR EXACT DRUG

- The drug calculator has presets for more than ten general drugs calculations, including aminophylline and inamrinone lactate (please refer to drug dosage range limitation table). *Drug*, *Concentration*, *Amount* and *Dose/min* or *Dose/(kg*min)* have range limitations. If the input item or calculation result is out of range, it is displayed in yellow digits.
- The drug dosage out of range prompt only advises the user to pay attention to use appropriate dose of the current drug. Final transfusion dose and transfusion process are determined by the doctor.

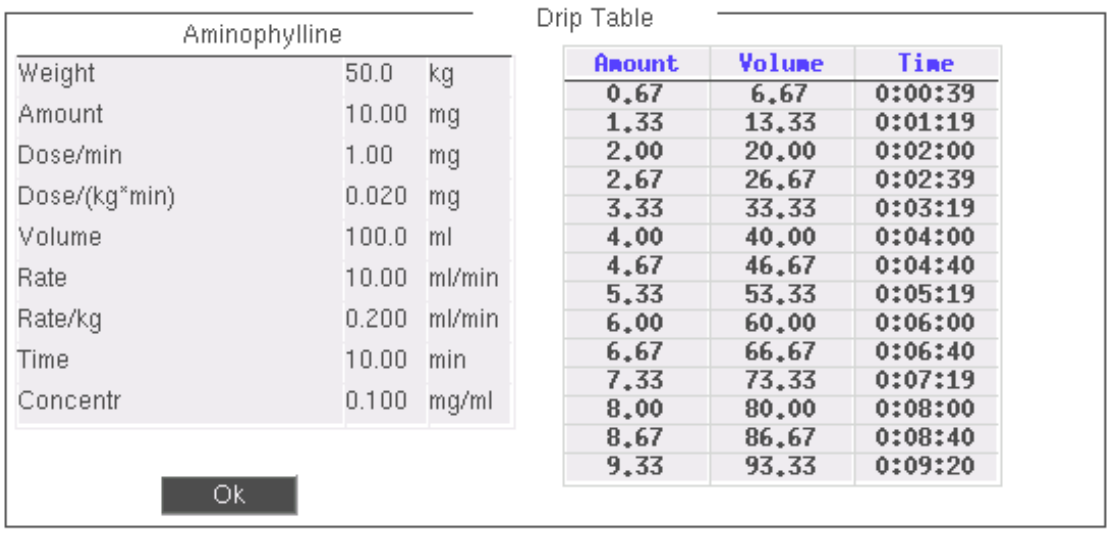
Drug dosage range limitation table

Drug name	Concentration	Dose/min (Dose/(kg x min))	Amount
Aminophylline	≤1mg/ml	≤25mg/min	250~500mg
Bretylium Tosilate	≤10mg/ml	1~50mg/min	5~10mg
Dobutamine	≤5mg/ml	2.5~40ug/kg/min	≤250mg
Dopamine	≤3mg/ml	≤1~30ug/kg/min	10~20mg
Epinephrine	<64ug/ml	1~4ug/min	0.025~1mg
Heparin Sodium	20~40U/ml	15~20U/kg/h±10%	6000~20000U
Inamrinone lactate	1~3mg/ml	5~10ug/kg/min	250~500mg
Isoprenaline/Isuprel	2~4mcg/ml	2~20mcg/min	500~1000mcg
Lidocaine	≤8mg/ml	1~4mg/min	50~100mg
Morphine Hydrochloride	≤5mg/ml	≤2mg/min	5~15mg
Nitroprusside	≤1mg/ml	0.5~10ug/kg/min	≤50mg
Nitroglycerin	50~400ug/ml	5~200ug/min	5~10mg
Oxytocin	0.01U/ml	0.001~0.04U/min	2.5~5U
Procainamide	2~4mg/ml	1~6mg/min	500~750mg

DRIP TABLE

Selecting Drip Table in the drug calculator window displays the following window showing quantity of liquid transfused and time remaining.

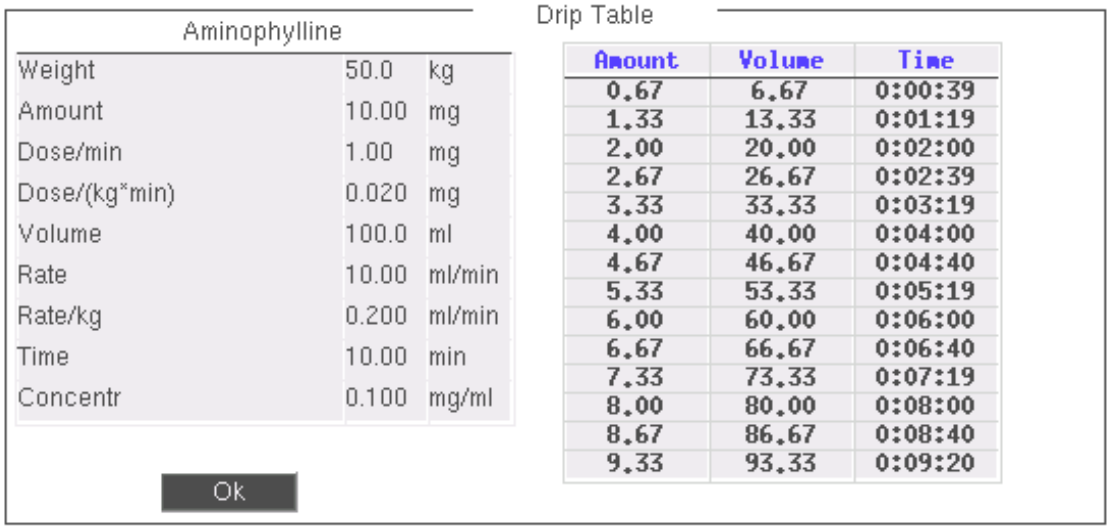
- The drip table displays quantities of the drug and liquor at each interval when the user enters the data into the drug calculator window.
- The left side of the window shows the data entered by the user (and calculation result) in the drug calculator window. The right side lists the amount and volume at 15 equal intervals.
- Items in this window cannot be modified.
- In the table, the unit relating to the weight is the same as the unit in the drug calculator window. The volume unit is ml.
- Select OK to exit the drip table window and return to the drug calculator window.



TITRATION TABLE

Selecting Titration Table in the drug calculator window displays the following window showing the dosage at different rates. The higher the rate is, the greater the steps between the items are.

- The titration table shows the dose, dose/min or dose/hr at different rates with the same concentration.
- The left side of the window shows the data entered by the user and calculation result in the drug calculator window. The right side shows the dose, dose/min or dose/hr at 30 rates, equally divided from the range in the benchmark item.
- In the list the user has two items of dose and rate.
- The range of dose/min or dose/hr is one to two times the dosage entered in the drug calculator.
- Select OK to exit the titration table window and return to the drug calculator window.



RESET

Select reset in the drug calculator window to clear the data and start a new calculation.

Exiting the drug calculator window or turning off the monitor, the drug calculator data entered by the user and the calculation result are saved.

When the user enters the drug calculator window, the last calculator data is displayed.

8. OTHER PATIENT VIEWING

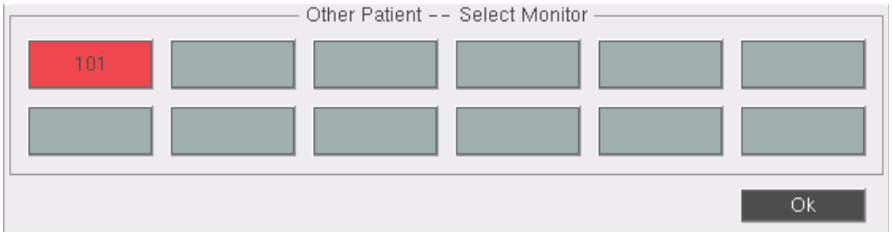
The L550 is able to view waveforms and measured parameter data from another patient monitor on the same monitoring network.

The 'other patient viewing' function has the following features:

- The other patient viewing function is recognised by the network, so the viewing and viewed monitors should both be connected to the same network.
- The LAN connection can be wired or wireless.
- The other patient viewing function does not depend on the central monitoring system. Whether the central monitoring system exists in the LAN does not affect this function.
- The L550 can only view one monitor at a time and only by one monitor.

SELECT MONITOR

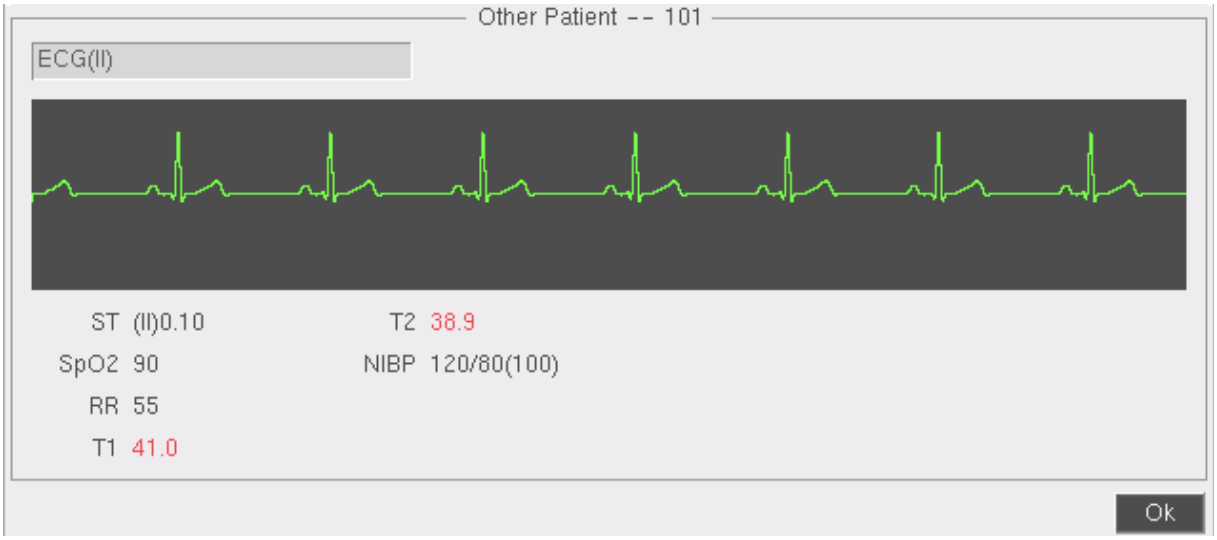
Select Tools in the Main Menu, and then select Other Patient, the following dialogue box is displayed.



- All the device names of the monitors connected to the network are listed in this dialogue box, such as '101 displayed in the diagram above.
- One page can list 12 device names. When the connecting monitors exceed 12 sets, the device names is displayed in divided pages and can be checked via Prev. and Next buttons.
- When the viewed monitor alarms, the device name has a red background, and the button restores to a blue background when the viewed monitor has no physiological alarms.
- If the same device names exist in a network, they will be listed as '*device name* * *serial No.*'.
- Turn the rotary controller to select the desired device name, and then press the rotary controller to check the waveforms and parameter values of the monitor.
- This information box cannot close automatically. Select the OK button or press the main menu button on the front panel to exit.

OTHER PATIENT

Select the desired device name in *Other Patient*. Select the monitor dialogue box to display the following window.



- All the real-time parameter values of the viewed monitor are displayed in the lower part of this window. If a parameter value exceeds the alarm limit of the viewed monitor, it is displayed in red.
- The parameter alarm doesn't change the audible alarm status of the viewing monitor. The parameter alarm is related to the alarm limit of the viewed monitor, and has no relation with the alarm switch, alarm tone of the viewed monitor and the relevant alarm settings of the viewing monitor.
- A real-time waveform of the viewed monitor is displayed in the waveform area. There is a waveform selection field at the top left corner. Select it, and the displayed waveform switches between all the parameter waveforms.
- This window cannot close automatically. Select OK or press the main menu button to exit.

9. ECG MONITORING

The L550 adopts 5-lead or 3-lead ECG cable, and can display seven or three leads of ECG signal simultaneously. The ECG channel displayed at the top of the screen is the major ECG signal channel. Its lead is called the major lead. The L550 calculates the heart rate and controls the gain (if set in automatic mode) according to the data of the main lead. All leads adopt the same gain and same measurement mode. The L550 can separately check whether the connection of a lead has fallen off, and prompts in the corresponding channel.

ECG MONITORING

In order to monitor the patient's ECG, a five-electrode ECG cable is used which can get more than 12 selective ECG leads. If a lead is effective, the corresponding waveform is displayed in the channels area.

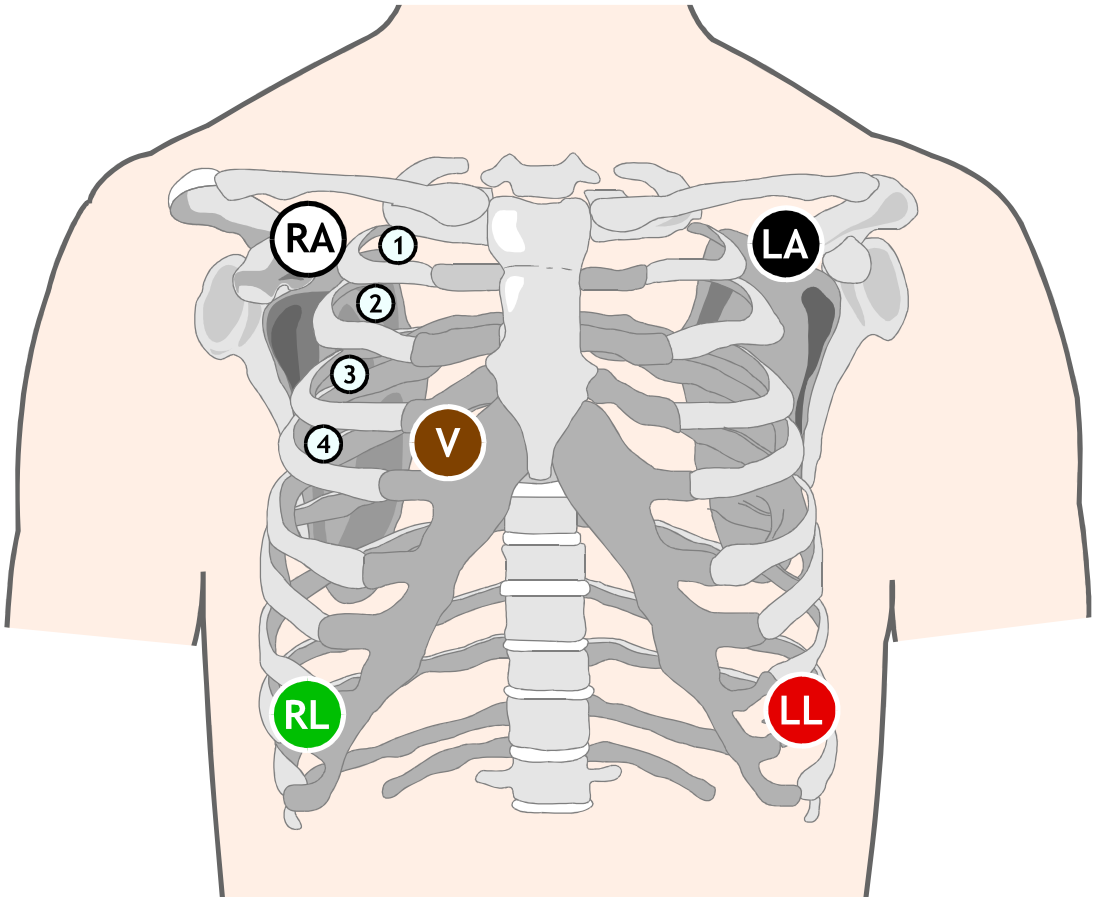
The ECG cable includes two parts: the main cable connecting the L550 and the electrode lead line connecting the patient.

PREPARATION

1. Select the electrode: Generally, the electrode for monitoring is a disposable electrode made from Ag-AgCl (silver - silver chloride). Before use, confirm that the electrode is within the valid date. If an out-of-date electrode is used, it can lead to inaccurate monitoring results.
2. **Skin pre-treatment**
   Skin is not a good conductor. Prior to attaching the electrode, perform skin pre-treatment to achieve good contact between the skin and the electrode.
   - If necessary, shave hair at the chosen site.
   - Remove grease from the skin.
   - Rub the skin to accelerate the blood flow in the organ capillaries.
   - Thoroughly cleanse the site with mild soap and water solution. Do not use ether or pure alcohol, as it increases skin resistance.
   - Dry the skin completely before applying the electrodes.
3. Attach the ECG lead to the electrodes prior to placement.
4. Place the electrode on the patient. If conductive ointment is not applied to the electrodes, apply it before the placement.
5. Connect the electrode lead to the patient cable.
6. Confirm the Monitor is powered on and ready for monitoring.

ELECTRODE PLACEMENT

For the placement of the five-lead ECG electrode, refer to the figure shown below.

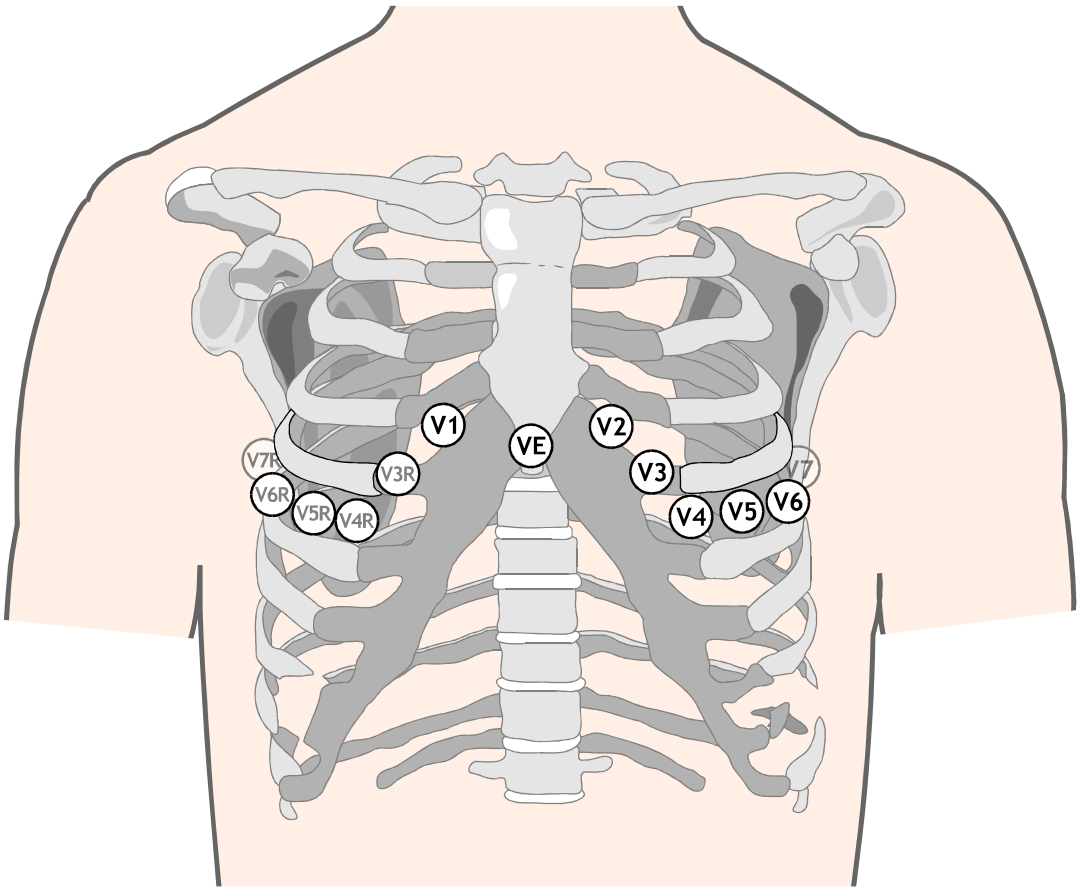


5-Lead electrode placement

NOTE: The name and colour of the electrodes shown above is the AMA convention. The alternate EIC convention is indicated below inside square brackets [].

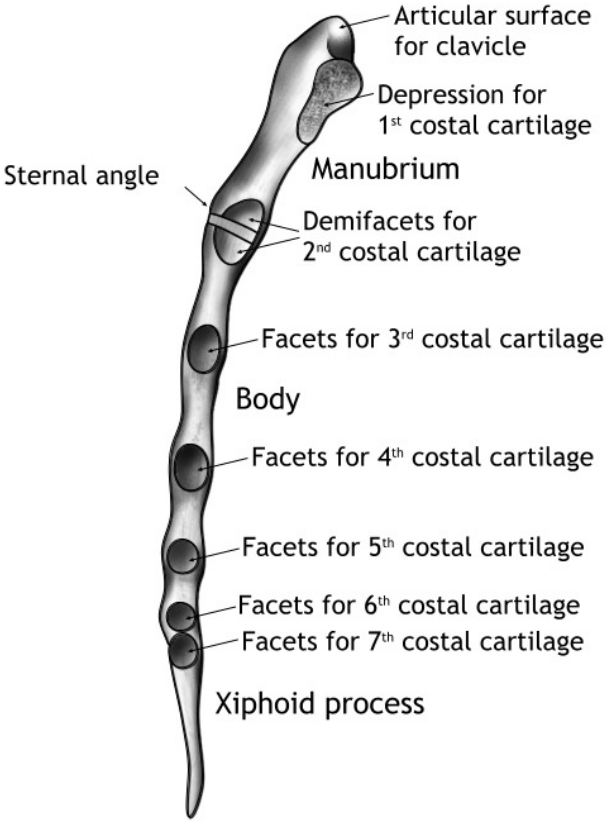
- **White** (right arm/RA) [*red*]: near the right shoulder, directly below the clavicle.
- **Black** (left arm/LA) [*yellow*]: near the left shoulder, directly below the clavicle.
- **Green** (right leg/RL) [*black*]: on the right abdomen.
- **Red** (left leg/LL) [*green*]: on the left abdomen.
- **Brown** (chest/V): on the chest (see below).

When using five leads, attach the chest electrode (V) to one of the following positions indicated below:



Chest electrode placement

In order to accurately install and monitor the 'V' lead, it is very important to determine the fourth rib position, which is determined according to the first rib position. Because of patients' different bodily forms, it can be difficult to accurately feel for the first rib position. First, find the small protruding body called the sternal angle or 'angle of Louis', formed by the junction of the manubrium and the body of the sternum. Then determine the second rib position, the protuding section of the breastbone indicates the joint of the second rib, right under here is the position of the second rib position. Feel down until the fourth rib position is determined.



Lateral border of sternum

Attach the chest (V) electrode to one of the following positions indicated in the illustration *Chest electrode placement* above;

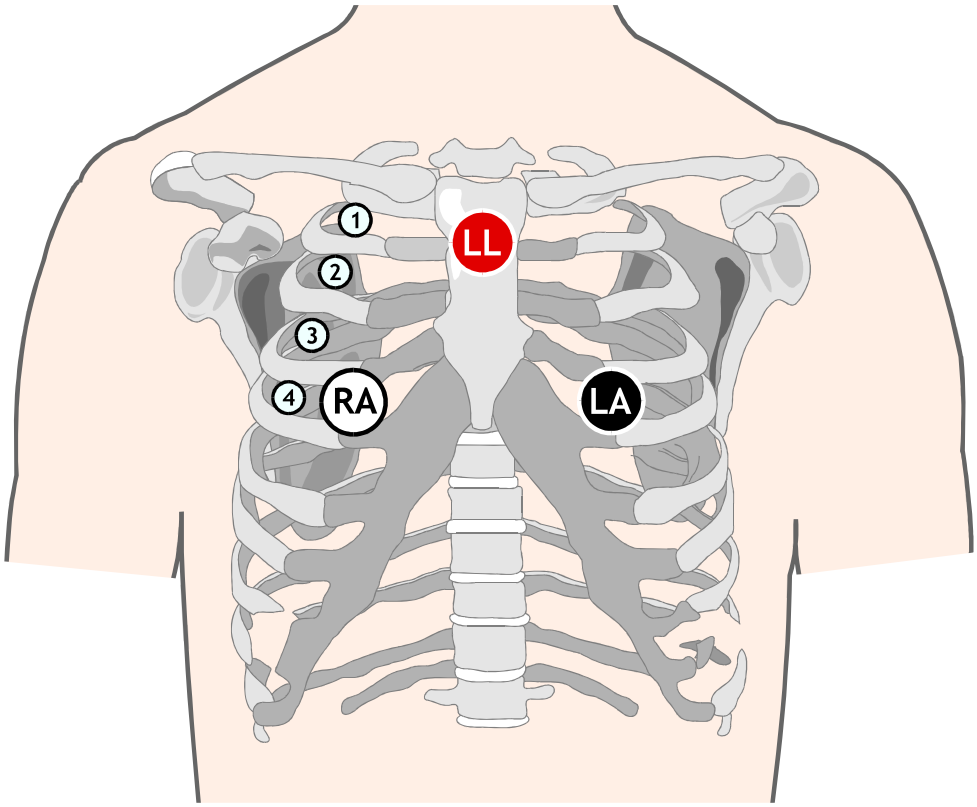
- V1: On the 4th intercostal space at the right sterna margin.
- V2: On the 4th intercostal space at the left sterna margin.
- V3: Midway between V2 and V4 electrodes.
- V4: On the 5th intercostal space at the left clavicular line.
- V5: On the left anterior axillary line, horizontal with V4 electrode.
- V6: On the left middle axillary line, horizontal with V4 electrode.
- V3R-V7R: On the right side of the chest in positions corresponding to those on the left.
- VE: Over the xiphoid process.

When attaching the chest electrode to the back of a patient, place it on one of the following sites:

- V7: On the 5th intercostal space at the left posterior axillary line of the back.
- V7R: On the 5th intercostal space at the right posterior axillary line of the back.

Electrode placement for pacemaker patients

The pacemaker lead can pick up the best ECG waveform from the patient. The electrode is usually placed on the mamillary line, the white and black electrodes are placed as shown below:



Electrode placement for pacemaker patients

Electrode placement for surgical patients

Electrode placement during surgery depends on the type of surgery being performed. For example, with open chest surgery, the electrodes might be placed laterally on the chest or on the back.

In the operating room, equipment can sometimes affect the ECG waveform due to the use of electrosurgery equipment. To help reduce this, place the electrodes on the right and left shoulders, the right and left sides near the stomach, and place the chest lead on the left side at mid-chest. Avoid placing the electrodes on the upper arms as this makes the ECG waveform too small.

NOTE: Select a site with a stable ECG signal or minimal inference of skeleton activities to place the electrodes.

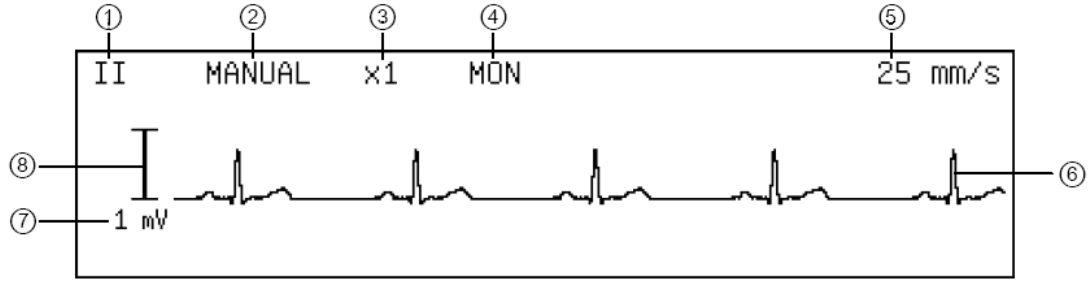
WARNING:

- To ensure patient safety, all leads shall be connected to the patient.
- Electrodes shhould be fixed properly to ensure reliable contact of the conductor with skin.
- Interference from nearby unearthed instruments and ESU interference can cause inaccuracy of the ECG waveform.
- When using electrosurgery equipment, never place the ECG electrodes near the earth point of the electrosurgery device. This causes a large amount of interference with the ECG signal. The patient leads should be placed in a position that is equal distance from the electrosurgery electrotome and the earth point to avoid burns to the patient.
- Always dispose or recycle electrodes properly to prevent environmental contamination.
- Verify lead fault detection prior to the start of monitoring. Unplug the ECG cable from the ECG connector, the flashing error message “Lead Off” is displayed in the corresponding ECG channel.
- Skin irritation may result from continuous application of ECG electrodes. These should be checked each day. If there is an indication of excess skin irritation, replace the electrodes or change the location of the electrodes every 24 hours.

ECG CHANNEL

MAIN LEAD CHANNEL

The top part of the channels area that cannot be changed to any other channels is called as the main lead channel, as shown below:



① Main lead title

② Gain mode

③ Gain

④ Measurement mode

⑤ Waveform speed

⑥ ECG waveform

⑦ Scale range

⑧ Scale

Selecting the main lead title displays the ECG channel menu:

Lead

Select the main lead – options are: I, II, III, aVR, aVL, aVF and V.
In order to get accurate heart rate and gain control performance, the user should select the lead of the largest range and least noise as the main lead. In order to avoid emerging leads repeatedly, when the lead in the current channel is switched, the leads in the other channels are changed automatically.

Gain Mode

Set the gain mode either AUTO or MANUAL. Gain is the magnitude of the ECG waveform signal. This monitor has five ranges: x1/4, x1/2, x1, x2 and x4.

×1 is one times magnification, under which the range ⑦ of the scale ⑧ on the left of the ECG waveform is 1mV. Using ×2 magnification, the range of the scale is 0.5mV, and so on.

For detailed data, refer to the following table:

Gain Factor	AUTO	MANUAL	Scale range
x1/4	adopted	applicable	4mV
x1/2	adopted	applicable	2mV
x1	adopted	applicable	1mV
x2	adopted	applicable	0.5mV
x4	adopted	applicable	0.25mV

Under 1 ECG and Huge Digit display formats, the length of the scale is 10mm. A 10mm waveform displayed in ×1 magnification means the ECG signal is 1mV; in ×2 the signal is 0.5mV.

NOTE: All leads including the main lead and other leads adopt the same gain.

The L550 provides two methods to regulate the ECG waveform range:

- AUTO mode: In AUTO mode, depending on the main lead waveform data, the L550 will automatically regulate the gain to amplify the ECG waveform of the main lead with the least distortion possible. The disadvantage of this mode is a slower response.
- MANUAL mode: In MANUAL mode, the L550 doesn't regulate the ECG gain automatically. The ECG gain is regulated via the 'Adjust Gain' button. This mode has a faster response - the waveform changes immediately when the gain is regulated.

Adjust Gain: Manually regulates the ECG gain. After selecting this button, regulate the gain via the rotary controller. Rotate anticlockwise to decrease the gain and waveform range and vice versa. After adjustment, press the rotary controller again to exit the Adjust Gain mode.

Mode: Selects the filter bandwidth of the ECG channel.
The L550 has three modes:

- Diagnosis (DIA)
- Monitoring (MON)
- Operation (OPR)

In DIA mode, the filter bandwidth is the widest, so more detailed ECG signal information is received. The more detailed information is helpful to more accurately judge the status of the ECG signal, however environmental noise, such as HF electrotome, can be received as well. The noise mixes with the actual ECG signal, and the resulting signal cannot be distinguished. In order to adapt to the noise interference, the monitor also provides two alternate measurement modes: MON and OPR. In these two modes a narrower bandwidth is adopted to measure and gain a smoother signal.

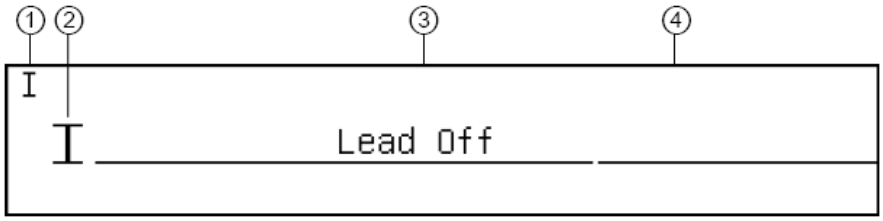
The user can choose depending to the circumstances, and comparing data as follows:

Mode	Bandwidth	Details	Noise
DIA	0.05Hz~100Hz	Max.	Max.
MON	0.5Hz~40Hz	Medium	Medium
OPR	1.0Hz~25Hz	Least	Least

NOTE: All leads including the main lead and other leads adopt the same mode.

Waveform speed: Select this button to regulate the waveform speed for parameters relating to ECG, including all ECG channels and the PLETH channel. There are four speeds: 6.25 mm/s, 12.5 mm/s, 25 mm/s and 50 mm/s.

OTHER LEAD CHANNELS



① Other lead title

② Scale

③ Lead off icon

④ ECG waveform

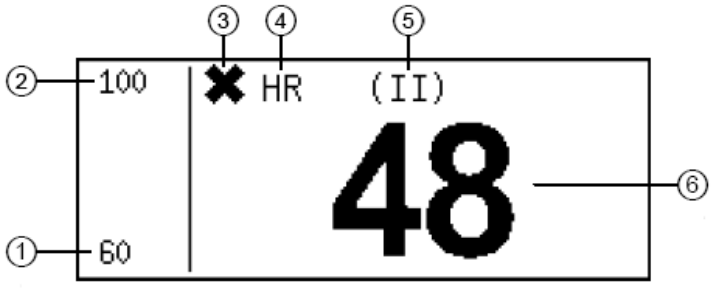
To change the current lead, select position ①, to choose the from 6 leads (except the main lead). Titles in different channels are different, when the lead title in the current channel is switched, the lead title in other channels is changed automatically.

If the ECG electrode falls off of the ECG cable or from the monitor, the flashing prompt information “Lead Off” is displayed in corresponding ECG channel.

ECG PARAMETER

HEART RATE

The heart rate is displayed on the top part of the parameters area, as shown below (except for when in Huge Digit mode):



① Lower alarm limit

② Upper alarm limit

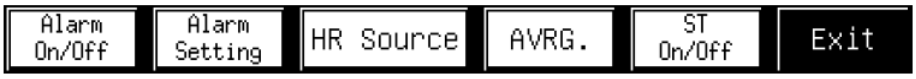
③ Alarm off icon

④ Heart rate title

⑤ Heart rate source symbol

⑥ Measured heart rate value

Select the heart rate title (HR) to display the HR menu as shown below:

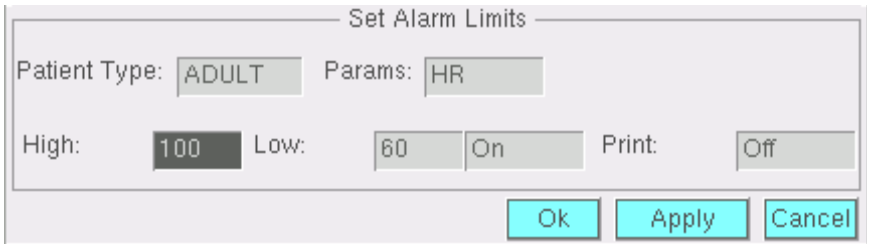


Alarm On/Off: Enables or disables the HR alarm.

Alarms enabled: The HR alarm is turned on and the L550 alarms when the measured HR value exceeds the preset alarm limit.

Alarms disabled: The ✖ icon is displayed to the left of the HR title. The HR alarm is turned off, and the monitor does not generate alarms when the measured HR value exceeds the preset alarm limit.

Alarm Setting: Selecting this button displays the *Set Alarm Limits* dialogue box as shown below:



The upper alarm limit, lower alarm limit, alarm switch and HR alarm printing switch can be set in this dialogue box.

HR Source

□Auto: The L550 determines the heart rate source depending on signal quality. ECG takes priority over SpO2. If the ECG signal is poor and cannot be analysed, SpO2 is selected as the HR source. If the ECG signal improves, the HR source changes to ECG automatically.

□ECG: HR is always calculated from ECG.

□SpO2: If the ECG signal is badly degraded, you can select SpO2. In this case PHR is derived from the PLETH waveform. '*PR (SpO2)*' is displayed instead of *'ECG (…)*' and the PR reading is displayed below. The monitor issues pulse beeps instead of heartbeat beeps.

The heart rate source mark and heart rate title clearly show the current heart rate source as in the following:

Label	Heart rate value colour	Heart rate source mark	Source
HR	Green	I, II, III, aVR, aVL, aVF, V	ECG
PR	Red	SpO2	SpO2

NOTE: The pulse rate and heart rate use the same alarm limit and alarm switch. No matter where the heart rate value comes from, the alarm systems adopted are totally the same.

AVRG.

Selecting this button displays the following menu:

The average period for heart rate (pulse rate) and ST segment calculation can be set in this menu.

□BT.BT. - The average period is 1 heartbeat.

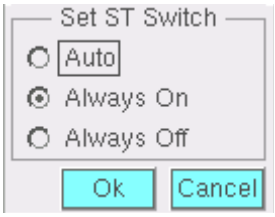
□4 Beats - The average period is 4 heartbeat.

□8 Beats - The average period is 8 heartbeat.

□16 Beats - The average period is 16 heartbeat.

ST On/Off

Selecting this button displays the *Set ST Switch* dialogue box, as shown below:



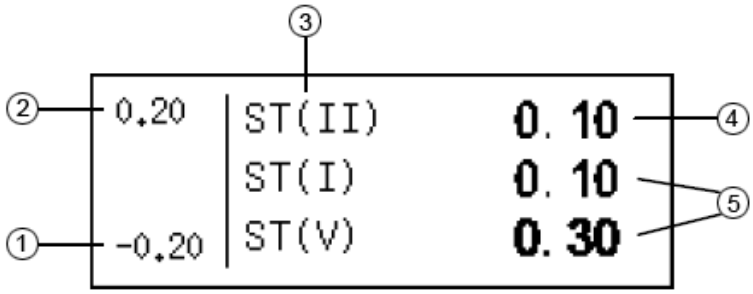
- **Auto**: The L550 either displays or hides the ST segment automatically according to the ECG mode. In DIA mode, the ST segment is displayed, and in MON and OPR mode, the ST segment is hidden.
- **Always On**: Always displays ST segment in the parameters area.
- **Always Off**: Hides ST segment.

ST SEGMENT

By default, the ST segment is always displayed. In MON or OPR mode, the ST numeric may be severely distorted. The variance of the ST segment at the waveform tracks can be measured and the result is displayed numerically in the parameters area.

Measurement symbols of the ST segment: '+' means positive elevation, '-' means negative elevation.

The ST segment is displayed as follows:



① Main lead ST segment lower alarm limit

② Main lead ST segment upper alarm limit

③ Main lead ST segment title

④ Main lead ST segment measured value

⑤ Measured values of other lead ST segments

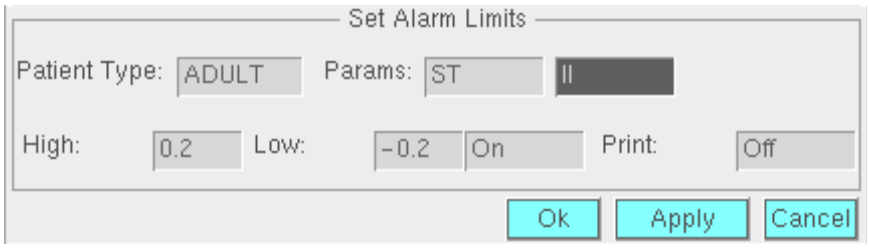
Selecting the main lead ST segment title, such as ST (II) displayed above displays the following menu:

Alarm On/Off: Enables or disables all the ST segment alarms.

Alarms enabled: The ST segment alarms are turned on, the L550 alarms when the measured ST segment value exceeds the preset alarm limit.

Alarms disabled: The ✖ icon is displayed to the left of the main lead ST segment title, the ST segment alarms are turned off; the L550 does not generate alarms if the measured ST segment value exceeds the preset alarm limit.

Alarm Setting: Selecting this button displays the *Set Alarm Limits* dialogue box as shown below:



The upper alarm limits, lower alarm limits, alarm switches and alarm printing switches of the ST segments can be set here.

ECG MAINTENANCE AND CLEANING

The exterior surfaces of the ECG cable may be cleaned with a soft cloth, dampened with the alcohol, and then be air-dried or dried with a clean dry cloth.

WARNING:

- If the ECG cable is damaged or aging, it shall be replaced by a new one.
- Before cleaning the ECG cable, be sure to disconnect the monitor from the ECG cable, or shut down the system and disconnect all power cords from the outlet.

ECG TROUBLESHOOTING

Problem	Causes	Solutions
Lead off.	The ECG electrode has fallen off from the patient or from the L550.	Ensure that the electrode, lead and cable are connected.
ECG signal noise is too high.	The wrong mode is selected.	Change the mode.
	The power frequency is not set correctly.	Set the correct power frequency.
	The electrode is not connected to the patient correctly.	Keep the patient quiet, and guarantee the reliable connection of the electrode.
	The L550 has bad earth.	Check the earth connection.
HR is not displayed.	The ECG signal is very weak. (<0.25mV).	Check the connection between the electrode and patient.
	The electrode is badly connected to the patient.	Ensure reliable contact between the electrode and patient's skin.
	The patient type is not set correctly.	Set the correct patient type.
	Gain is too low.	If in MANUAL mode, select an appropriate gain.

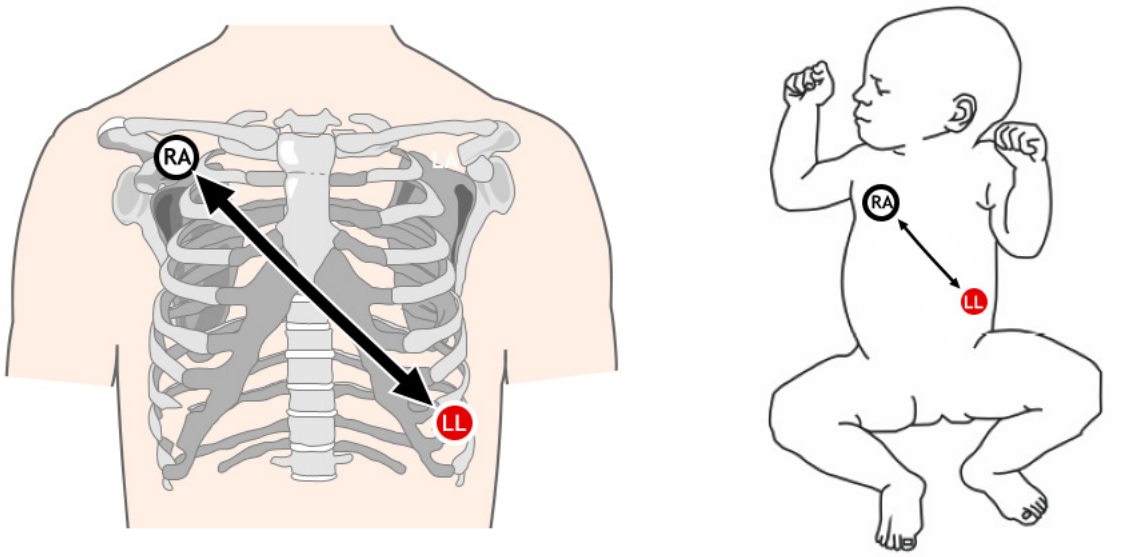
10. RESP MONITORING

The L550 measures respiration movement waveform by the ECG cable using the impedance method. The respiration movement waveform is used to calculate the respiration rate and analyse the respiration status.

The L550 can measure three lead respiratory waveforms including I, II or III lead, of which, the II lead is generally used. Because of the different signal strength, the L550 provides AUTO and MANUAL modes to adjust the gain. The respiratory waveform will be clear and without distortion if an appropriate gain is adopted.

ELECTRODE PLACEMENT

The method is used to monitor the patient's respiration is by impedance respiration based on the variation between the two electrocardiogram electrodes of the I, II or III lead. As the same electrodes are used for ECG and RESP monitoring, the electrode placement is very important. Some patients expand their chest laterally because of their clinical condition which causes negative thoracic pressure. In these cases it is better to place the two electrodes used for RESP monitoring laterally in the right axillary and left lateral chest areas, at the maximum point of the breathing movement, to optimise the respiratory waveform.



NOTE:

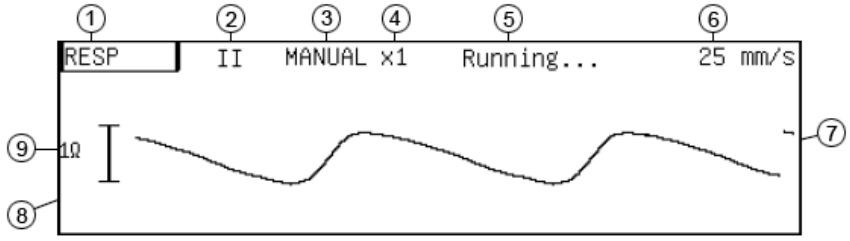
- RESP monitoring is not recommended on very active patients, because it can cause false alarms.
- Place the red and white electrodes diagonally to optimise the respiration waveform.
- To prevent cardiac artefacts on the ECG, avoid placing the electrodes so that the liver area and the ventricles of the heart are in line between the respiration electrodes. This is particularly important when monitoring neonatal patients.

MONITORING INTERFACE

The RESP monitoring displays a RESP waveform in the channel area and the measured respiration rate value in the parameter area.

RESP CHANNEL

The RESP channel is displayed as shown below:



① **RESP channel title:** Selecting this title displays the RESP menu.

② **Lead type**: I, II or III.

③ **Gain mode**: AUTO or MANUAL.

④ **Gain**: Four levels: x1/2, x1, x2 and x4. If the gain is too high, the top of the waveform may be clipped and will be displayed as a straight line.

⑤ **Status prompt bar**.

⑥ **Waveform speed**: 6.25mm/s, 12.5mm/s, 25mm/s or 50mm/s.

⑦ **RESP waveform**.

⑧ **Scale**.

⑨ **Scale range:**
The unit is Ohm (Ω). The length and range are different at different gain levels.

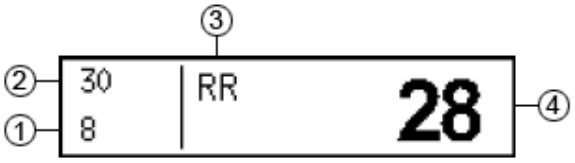
Selecting the RESP channel title displays the RESP menu:

- RESP mode: Selecting this button switches the channel to T-RESP channel.
- Gain Mode: Selecting this button changes the gain mode between AUTO and MANUAL.
- Adjust Gain: This button is available only in manual mode. Select this button then turn the rotary controller to adjust the gain; four are available: ×1/2, ×1, ×2 and ×4. Press the mouse to choose the gain adjustment.
- Lead: Selecting this button switches the waveform switches the waveforms of I, II and III leads.
- Waveform Speed: Selecting this button switches the waveform speed between among 6.25mm/s, 12.5mm/s, 25mm/s and 50mm/s. Decrease it, the waveform is compressed, and you will see longer time quantum; increase it, the waveform is expanded, and you will get more detailed view. The 'Waveform Speed' button in the display menu also can be used to change the RESP waveform speed. No

matter which method is used, it will change both the waveform speed of the RESP and T-RESP simultaneously.

RESPIRATION RATE

The respiration rate is displayed in the parameters area, as shown below:



① **Lower alarm limit**. The L550 generates alarms when the measured respiration rate value is lower than the set limit.

② **Upper alarm limit**. The L550 generates alarms when the measured respiration rate value is higher than the set limit.

③ **Respiration rate title**.

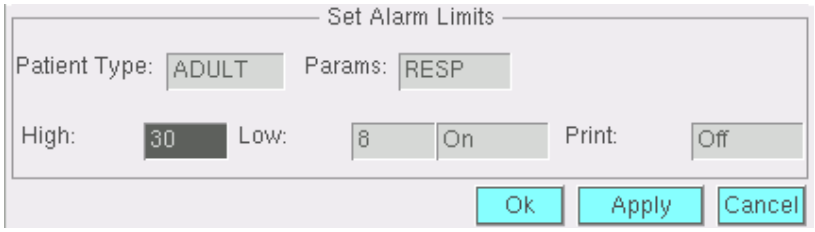
④ **Measured respiration rate value**.

Selecting the respiration rate title (RR) displays the following menu:

Alarm On/Off: Enables or disables the RR alarm.

> **Alarms enabled**: The RR alarm is turned on and the L550 alarms when the measured RR value exceeds the preset alarm limit.
>
> **Alarms disabled**: The ✖ icon is displayed on the left side of the RR title, the RR alarm is turned off, and the L550 does not generate alarms when the measured RR value exceeds the preset alarm limit.

Alarm Setting: Selecting this button displays the following *Set Alarm Limits* dialogue box.



The upper alarm limit, lower alarm limit, alarm switch and RR alarm printing switch can be set in this dialogue box.

RR Source: Selecting this button displays the following menu:

The respiration rate source can be viewed and selected in this menu.

There are four options: □Auto, □RESP, □T-RESP and □CO2.

The L550 displays the RR value calculated from the chosen source. If set to □Auto, the RR source depends the current channel, either RESP when RESP channel is displayed or T-RESP when T-RESP channel is displayed.

PROMPT MESSAGES

In the status prompt bar of the RESP channel, the current respiration status message is displayed.

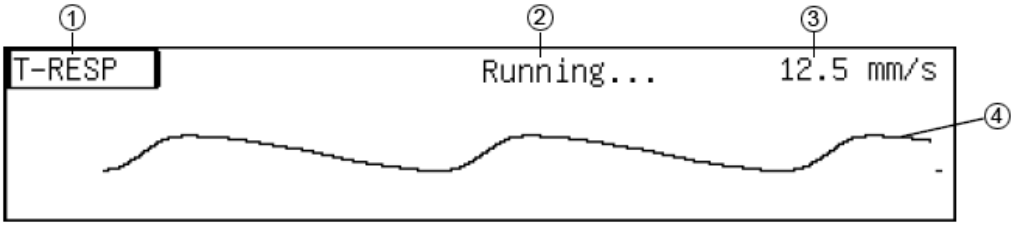
Lead Off: The current lead is not properly connected. When the lead is not plugged into the L550 or connected to the patient, this message is displayed.

Running: Except the above mentioned condition, the system prompts 'Running'.

11. T-RESP MONITORING

T-RESP CHANNEL

T-RESP monitoring is nasal tube respiration monitoring. In the default settings, the RESP channel is displayed, and it can be switched to the following T-RESP channel via RESP mode button in the RESP menu.



① T-RESP channel title. Selecting this title displays the T-RESP menu.

② Status prompt message. Always shows 'Running'.

③ Waveform speed. Four speeds are available: 6.25, 12.5, 25 and 50mm/s.

④ T-RESP waveform.

T-RESP MENU

Select the T-RESP channel title to display the following menu:

- RESP mode: Selecting this button switches the channel to RESP.
- Waveform Speed: Selecting this button switches the waveform speed between 6.25, 12.5, 25 and 50mm/s. The waveform speed button in the display menu also can be used to change the T-RESP waveform speed. No matter which method is used, it will change both the waveform speed of the RESP and T-RESP simultaneously.

NOTE: The T-RESP respiration rate is displayed at the same position of the RESP respiration rate. To display it, you can set the RR Source as T-RESP or Auto.

MAINTENANCE AND CLEANING

In there is a problem in the sampling system, check to see if the tube is tangled. If not, the tube may be blocked, and should be replaced.

WARNING:

- The nasal tube is disposable and must not be re-sterilised or reused.
- Do not press or fold the nasal tube.
- The nasal tube should be recycled or disposed of complying with the local laws.

12. NiBP MONITORING

The non-invasive blood pressure (NiBP) module measures blood pressure using the oscillometric method. This monitor can be used with adult, paediatric and neonatal patients. Three measurements are available: *Manual*, *Auto* and *Continuous*. Each mode displays the systolic pressure (SYS), mean arterial pressure (MAP) and diastolic pressure (DIA).

- **Manual**: Pressing the NIBP button on the front panel starts NIBP measuring.
- **Auto**: The NIBP measurement is conducted automatically at a preset interval.
- **Continuous**: The NIBP measurement is performed as many times as possible in five minutes.

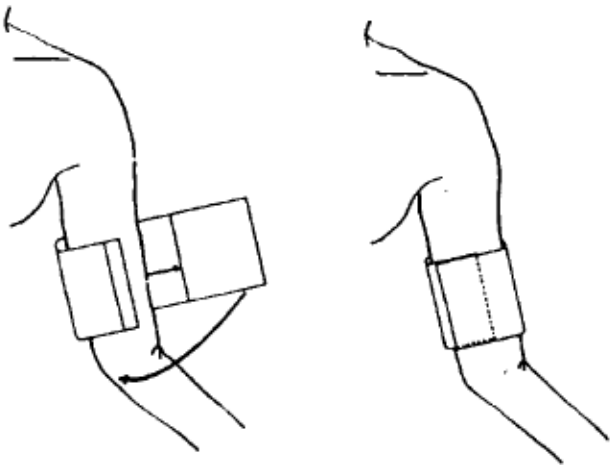
MONITORING PROCEDURE

To perform NIBP measurement on a patient, follow the procedure below:

1. Power on the L550.
2. Check the patient type. If the patient type is incorrect, select a correct patient type in the 'Patient Information' dialogue box.
3. Plug the hose in the NIBP cuff connector of the L550.
4. Apply a cuff of proper size to the upper arm or the leg of the patient.
5. Connect the cuff with the air hose.
6. Press the NIBP button on the front panel to start the measurement.

CUFF SELECTION AND PLACEMENT

1. Identify the patient limb circumference.
2. Select the appropriate cuff. Limb circumference is identified on each cuff.
3. Check the cuff is completely deflated; place cuff around extremity being used and make sure the mark Φ is aligned with the artery.
4. Check the cuff is not wrapped too tightly around the limb. Excessive tightness may cause discolouration or ischemia.
5. Make sure that the cuff edge lies within the range of the <-> mark. If it does not, use a larger or smaller cuff that fits better.



NOTE

- The width of the cuff should be either 40% of the limb circumference (50% for neonates) or 2/3 of the upper arm length. The inflatable part of the cuff should be long enough to circle 50-80% of the limb. The wrong size cuff can cause incorrect readings.
- The limb chosen for taking the measurement should be placed at the same level as the patient's heart. If this is not possible, use the following method to correct the measurement result:
    - If the cuff is placed higher than the heart level, add 0.75mmHg (0.10 kPa) for each centimetre of difference, or 1.9mmHg (0.25kPa) for each inch of difference.
    - If the cuff is placed lower than the heart level, deduct 0.75 mmHg (0.10 kPa) for each centimetre of difference, or 1.9mmHg (0.25kPa) for each inch of difference.
- **If there is doubt about the accuracy of any reading(s), check the patient's vital signs by an alternative method before checking the function of the monitor.**

WARNING

- Use only the DARAY approved accessories for monitoring, or the monitor may be damaged.
- Do not perform NIBP measurements on patients with sickle-cell disease or under any condition where the skin is damaged or expected to be damaged.
- For patients with thrombasthenia, it is important to determine whether measurement of the blood pressure should be done automatically.
- Ensure that the settings are correct when performing measurements on children. Incorrect patient type setting may cause a danger to the patient because adult blood pressure level is higher than children.
- Before the measurement, confirm the configuration is suitable to the patient (adult, paediatric or neonate).
- Do not apply the cuff to a limb that has an intravenous infusion or catheter in place. This could cause tissue damage around the catheter when infusion is slowed or blocked during cuff inflation.
- Auto non-invasive blood pressure measurements performed over long periods may incur ischemia and neuropathy in the limb wearing the cuff. When monitoring a patient, examine the extremities of the limb frequently for normal colour, warmth and sensitivity. If any abnormality is observed, change the position of the cuff on the patient or stop the blood pressure measurements immediately.
- Make sure the tubing connecting the blood pressure monitor is not blocked, twisted, or tangled.

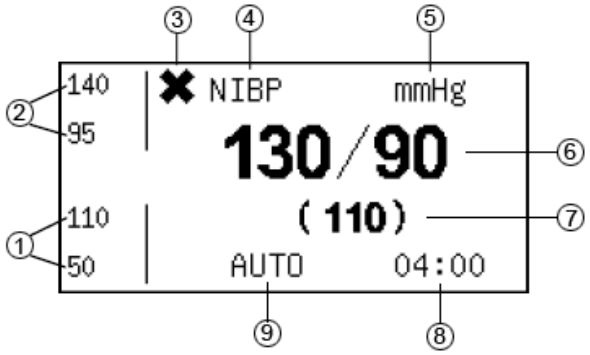
MEASUREMENT LIMITATIONS

Non-invasive blood pressure measurement uses an oscillometric method of measurement. The L550 detects the regular arterial pressure pulse. In some circumstances when the patient's condition makes it difficult to detect this pulse, the measurement can become unreliable and the measurement time increases. You should be aware that the following conditions could interfere with the measurement, make the measurement unreliable, prolong the measurement, or even make a measurement impossible.

- **Patient movement**: Patient is moving, shivering or jerking.
- **Cardiac arrhythmia**: The arrhythmia causes an irregular heartbeat.
- **Heart-lung machine**: Measurements is not possible if the patient is connected to a heart-lung machine.
- **Pressure changes**: The patient's blood pressure is changing rapidly over the period of time during which the arterial pressure pulses are being analysed to obtain the measurement.
- **Severe shock**: If the patient is in severe shock or hypothermia, reduced blood flow to the peripheries will cause reduced pulsation of the arteries.
- **Heart rate extremes**: The L550 is unable to perform pressure measurements at a heart rate less than 15 bpm or greater than 300 bpm.

MONITORING INTERFACE

The NIBP measurement does not produce any waveform. Instead, it displays the measurement result in the parameters area as shown below:



① **Diastolic pressure alarm limit**. When the measured diastolic pressure value exceeds this limit, the monitor generates alarms.

② **Systolic pressure alarm limit**. When the measured systolic pressure value exceeds this limit, the monitor generates alarms.

③ **NIBP alarm off icon**. When the alarms for systolic pressure, diastolic pressure and mean arterial pressure are disabled, this icon is displayed. If one of them is enabled, this icon is hidden.

④ **NIBP title**. Select this title to access the NIBP menu.

⑤ **NIBP unit**: mmHg or kPa. Refer to *REGION SETTINGS* on p.28 to set.

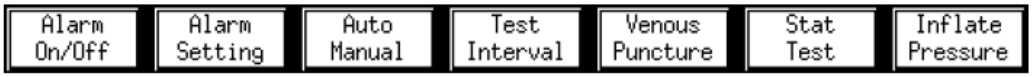
⑥ **Measured systolic pressure (SYS) and diastolic pressure (DIA) values**. Systolic pressure value is on the left and diastolic is on the right.

⑦ **Measured mean arterial pressure (MAP) value**.

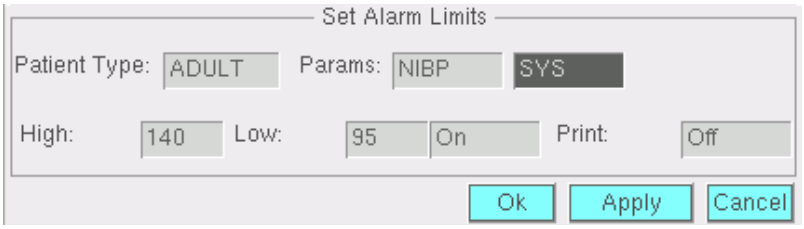
⑧ **Information prompt bar**.

⑨ **Information prompt bar.**

Selecting the NIBP title displays the following NIBP menu:

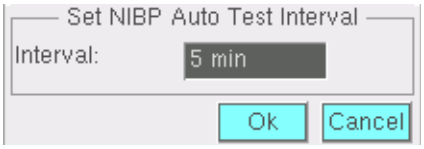


- Alarm On/Off: Enables or disables the alarms for SYS, DIA and MAP simultaneously.
  - **Alarms enabled**: The NIBP alarm is turned on and the monitor alarms when the measured NIBP value exceeds the preset alarm limit.
  - **Alarms disabled**: The ✖ icon is displayed on the left side of the NIBP title, the NIBP alarm is turned off, and the monitor does not generate alarms when the measured NIBP value exceeds the preset alarm limit.
- Alarm Setting: Displays the following *Set Alarm Limits* dialogue box::



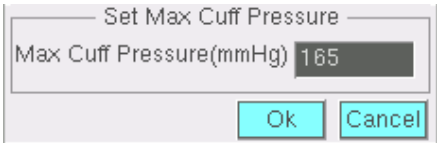
The upper alarm limits, lower alarm limits, alarm switches and alarm printing switches for SYS, DIA and MAP can be set in this dialogue box.

- Auto Manual: Switches between AUTO and MANUAL modes. In MANUAL mode, the word 'MANUAL' is displayed at position ⑨; while in AUTO mode, the word 'AUTO' is displayed at position ⑨ with the clock format time at position ⑧.
- Test Interval: In AUTO mode displays the following *Set NIBP Auto Test Interval* dialogue box.



In this dialogue box, the NIBP automatic measurement interval time, set to 5 min by default, can be set in the range from 2 minutes to 8 hours and is displayed in the information prompt bar.

- Venous Puncture: Venipuncture setting.
- Stat Test: Selecting this button starts a continuous measurement for five minutes.
- Inflate Pressure: In MANUAL mode, displays the following *Set Max Cuff Pressure* dialogue box:



The default max cuff pressure is 165mmHg for adult, 145mmHg for paediatric and 125mmHg for neonate.

FUNCTIONS

The NIBP monitoring has two functions: NIBP measurement and the venipuncture function.

NIBP MEASUREMENT

When the NIBP measurement starts, the L550 inflates the cuff, and the SYS, DIA and MAP are measured via the sensor. The measurement process lasts about 40 seconds.

There are three NIBP measurement modes: manual, auto and continuous.

Manual mode

Select the Auto Manual button in the NIBP menu, if word MANUAL is displayed at position 9, manual mode is selected. In this mode, a NIBP measurement can be started manually by pressing the NIBP button on the front panel. Before manual NIBP measurement, the max cuff pressure should be set to a proper value.

Auto mode

Select the Auto Manual button in the *NIBP* menu, if AUTO is displayed, AUTO mode is selected. In AUTO mode, the L550 periodically starts NIBP measurement automatically at the preset time interval. In AUTO mode the NIBP module is either paused or running.

When running, measurement takes place and the clock counts down, indicating the time remaining until the next measurement.

Whilst paused, press the NIBP button to start AUTO measurement - the clock begins to run.

Switching to MANUAL mode, then back to AUTO mode stops AUTO measurement.

Pressing the NIBP button during measurement can stops and pauses NIBP measurement.

Continuous mode

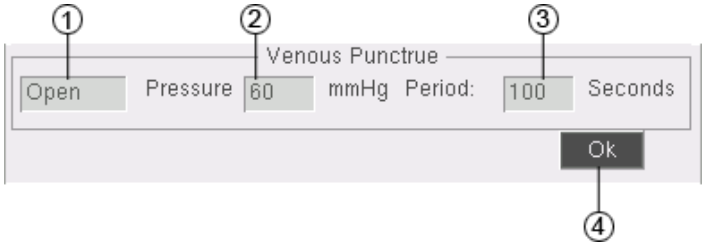
The Stat Test button in the *NIBP* menu starts a continuous measurement that is suited for a surgical or an emergent patient. It continuously measures NIBP for five minutes once started, and the measurement mode used is simpler than other modes. After five minutes, the monitor reverts to the previous mode (AUTO or MANUAL).

NOTE:

- Whether in AUTO or MANUAL mode, pressing the NIBP button on the front panel starts NIBP measurement.
- Pressing the NIBP button during NIBP measurement stops the ongoing measurement and deflates the cuff.

VENIPUNCTURE

In VENIPUNCTURE mode, the L550 inflates the air into the cuff to a preset pressure, and keeps the pressure during the preset time, then deflates. Select the Venous Puncture button in the *NIBP* menu, the following dialogue box is displayed:



① Venipuncture switch: Enables or disables the venipuncture.

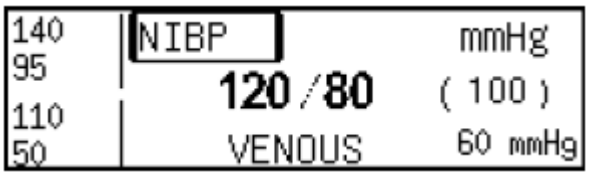
- Open: The venipuncture is turned on, the word VENOUS and the preset pressure are displayed in the information prompt bar, shown as the figure below.
- Close: The venipuncture is disabled.

② Pressure: The air inflation pressure.

③ Duration: From the air inflation time, until the air is deflated.

Patient type	Pressure setting range	Default pressure	Maximum duration
Adult	20~120 mmHg	60 mmHg	170 seconds
Paediatric	20~80 mmHg	40 mmHg	170 seconds
Neonatal	20~50 mmHg	30 mmHg	85 seconds

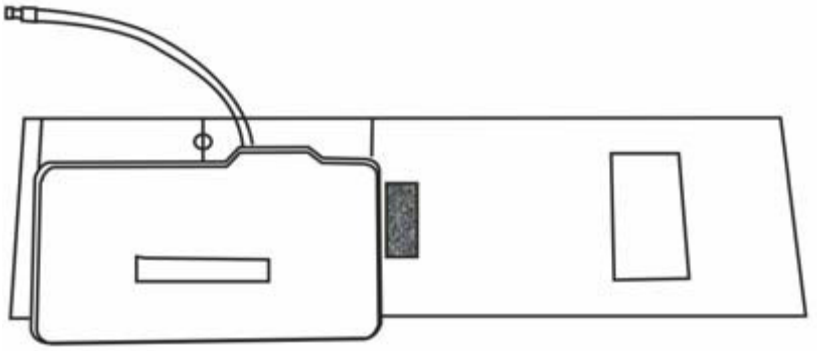
④ Select this button to confirm the setting.

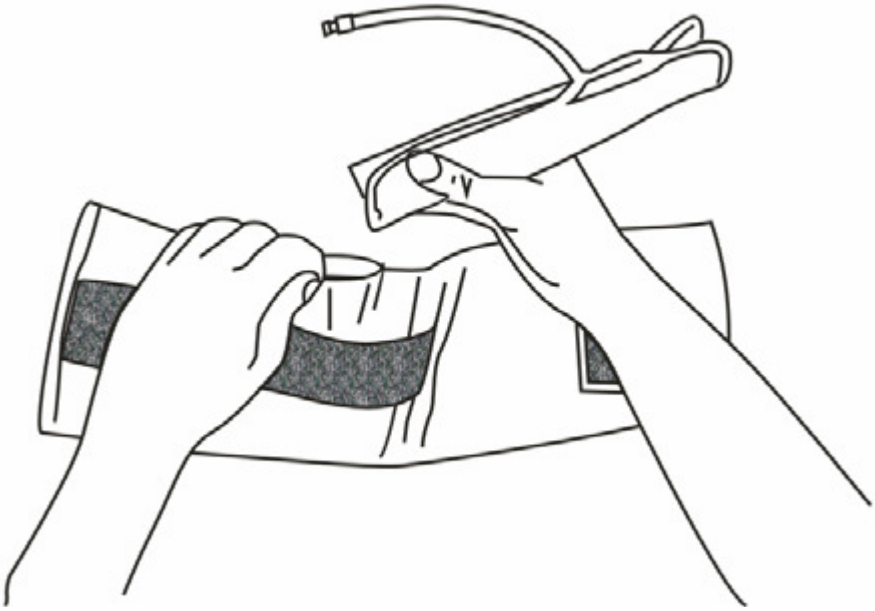


Whilst in venipuncture mode, press the NIBP button to start and stop inflation.

MAINTENANCE AND CLEANING

Reusable blood pressure cuffs: The cuff is not suitable for dry-cleaning. Instead, it should be machine or hand washed. Hand washing, may prolong the service life of the cuff. Before washing, remove the latex rubber bladder. Allow the cuff to dry thoroughly after washing, and then reinsert the rubber bladder. The cuff can be disinfected by means of conventional autoclave, gas, or radiation disinfection in hot air ovens, or sterilized by immersion in decontamination solutions. Remember to remove the rubber bladder if you use this method.





To replace the rubber bladder in the cuff:

1. Place the bladder on top of the cuff so the rubber tubes line up with the large opening on the long side of the cuff.

2. Roll the bladder lengthwise and insert it into the opening on the long side of the cuff.

3. Hold the tubes and the cuff and shake the complete cuff until the bladder is in position.

4. Thread the rubber tubes from inside the cuff, and out through the small hole under the internal flap.

Disposable blood pressure cuffs

Disposable cuffs are intended for single patient use only. Do not sterilize or use autoclave sterilization for disposable cuffs. Disposable cuffs can be washed with a mild soap and water solution to control the infection.

NOTE: Disposable blood pressure cuffs must be recycled or disposed of properly, complying with local laws.

WARNING:

- Do not press or limit the rubber tube on the cuff.
- Do not allow the water or detergent liquid get inside the NIBP connection, otherwise the L550 may become damaged.
- When a reusable cuff is not connected to the L550 or is being cleaned, avoid splashing liquid into the rubber tube or the L550.
- When cleaning the L550, only clean the connector external part, and do not clean its internal part.

TROUBLE SHOOTING

The NIBP current status is displayed at the position 9, please adopt the following disposals if the messages shown as below appear.

Problem	Cause	Solution
Startup fail	Monitor hardware error	Stop NiBP measurement and contact DARAY customer services
No cuff	The cuff is not fitted correctly or no cuff is connected	Fit the cuff correctly or attach cuff to the monitor
Cuff leak	The cuff, rubber tube or connector is damaged	Check and replace
Pulse too weak	The cuff is too loose or the patients pulse is too weak	Use another method of NiBP measuring
Over pressure	The pressure exceeds the specified safety upper limit	Re-measure, if failure continues stop NiBP measuring and contact DARAY customer services

13. TEMP MONITORING

TEMPERATURE PROBE INSTALLATION

The L550 is able to use two temperature probes simultaneously. Attach the temperature probe to the patient's body where ought to be measured, to obtain two temperature values and the difference between them.

If a disposable temperature probe is used, plug the temperature probe cable in the temperature probe connector, and then connect the temperature probe with the cable; if a reusable temperature probe is used, connect the temperature probe with the temperature probe connector directly.

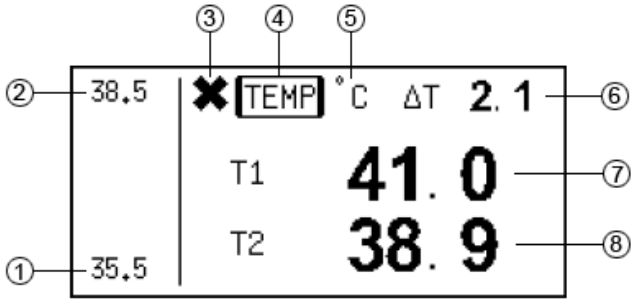
NOTE: The disposable temperature probe is for single patient use only.

WARNING:

- Be careful to avoid damaging the temperature probe and cable. When the temperature probe and cable are not in use, shape them into a loose round. If the cable is tangled too tightly or over-bent, mechanical damage may occur.
- The calibration of the temperature measurement function should be every year (or as dictated by your hospital procedures policy). If the temperature measurement function requires calibration, contact DARAY customer services.

TEMP PARAMETER

The temperature measurement result is displayed in the parameters area, as shown in the figure below:



① Temperature lower alarm limit. When the measured temperature value is less than the set limit, the L550 generates alarms.

② Temperature upper alarm limit. When the measured temperature value is greater than the set limit, the L550 generates alarms.

③ Temperature alarm off icon. Displayed when the temperature alarm is disabled.

④ Temperature title.

⑤ Temperature unit: ˚C or ˚F.

⑥ Temperature difference: The difference between the temperatures of the two channels.

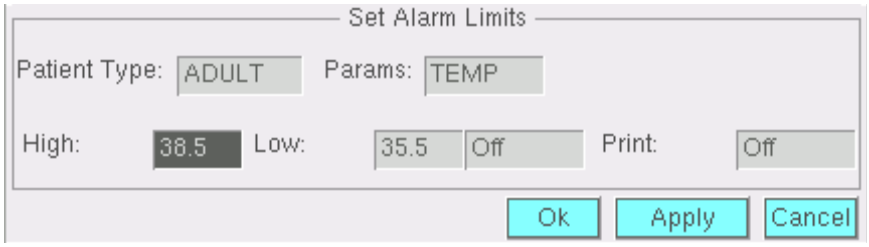
⑦ Measured temperature value of channel 1: Measurement range: (25.0-45.0)˚C.

⑧ Measured temperature value of channel 2: Measurement range: (25.0-45.0) ˚C.

TEMP MENU

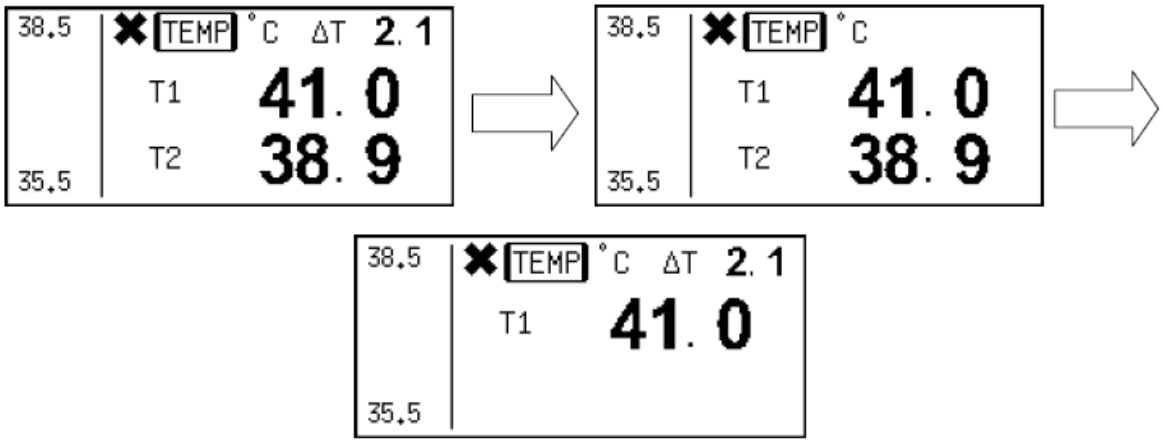
Selecting the temperature title in the parameters area displays the following menu:

- Alarm On/Off: Enables or disables the TEMP alarm.
  - Alarms enabled: The TEMP alarm is turned on and the L550 alarms when the measured TEMP value exceeds the preset alarm limit.
  - Alarms disabled: The ✖ icon is displayed on the left side of the TEMP title, the TEMP alarm is turned off, and the L550 does not generate alarms when the measured TEMP value exceeds the preset alarm limit.
- Alarm Setting: Selecting this button displays the following *Set Alarm Limits* dialogue box.



The upper alarm limit, lower alarm limit, alarm switch and alarm printing switch of TEMP can be set in this dialogue box.

- Mode: Selecting this button switches the TEMP display between three modes. One displays the temperatures of two channels and the temperature difference, the second displays the temperatures of two channels, and the third displays the temperature of channel 1 and the temperature difference. The mode can be selected as shown below:



MAINTENANCE AND CLEANING

WARNING: Before cleaning the L550 or the probe, make sure the L550 is turned off and disconnected from AC power.

Reusable temperature probes

- The temperature probe should not be heated to over 100°C (212°F). It can able to bear a temperature of between 80 and 100°C (176 to 212°F) for a short time.
- The probe must not be disinfected in steam.
- Only use alcohol-based detergents for disinfection.
- The rectal probes should be used, if possible, with a protective rubber cover.
- To clean the probe, hold the tip with one hand and with the other hand rub the probe down in the direction of the connector using a moist lint-free cloth.

NOTE:

- Disposable temperature probes must not be re-sterilised or reused.
- Disposable temperature probes must be recycled or disposed accordingly and comply with local laws.

14. SpO2 MONITORING

SpO2 measurement is based on two principles:

1. Oxyhemoglobin and deoxyhemoglobin differ in their absorption of red and infrared light.
2. The volume of arterial blood in tissue changes during the pulse.

The L550 determines SpO2 (oxygen saturation) by passing red and infrared light into an arteriolar bed and measuring changes in light absorption during the pulsatile cycle. Red and infrared light-emitting diodes (LEDs) in the sensor serve as light sources and a photo diode serves as the detector.

Because oxyhemoglobin and deoxyhemoglobin differ in light absorption, the amount of red and infrared light absorbed by blood is related to haemoglobin oxygen saturation. To identify the oxygen saturation of arterial haemoglobin, the L550 uses the pulsatile nature of arterial flow.

During systole, a new pulse of arterial blood enters the vascular bed, and the blood volume and light absorption increase.

During diastole, the blood volume and light absorption reach their lowest point.

The monitor bases its SpO2 measurements on the difference between maximum and minimum absorption (i.e., measurements at systole and diastole). By doing so, it focuses on light absorption by pulsatile arterial blood, eliminating the effects of none pulsatile absorbers such as tissue, bone, and venous blood.

The L550 determines SpO2 and pulse rate by passing two wavelengths of light, one red and one infrared, through body tissue to a photo detector. During measurement, the signal strength resulting from each light source depends on the colour and thickness of the body tissue, the probe placement, the intensity of the light sources, and the absorption of the arterial and venous blood (including the time varying effects of the pulse) in the body tissue.

The L550 processes these signals, to identify the pulse rate and calculate oxygen saturation. Oxygen saturation calculations can be performed because oxygen saturated blood predictably absorbs less red light than oxygen depleted blood.

The L550 can be used under low perfusion with the same accuracy as under normal conditions.

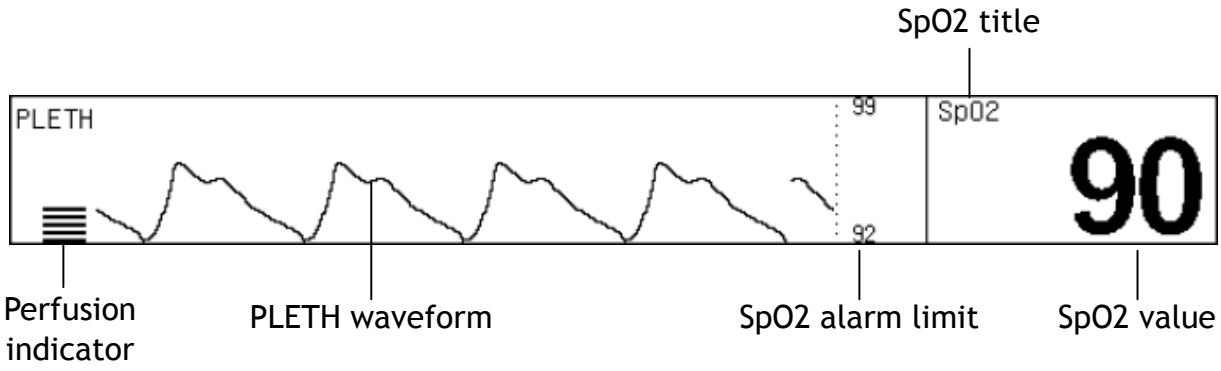
The L550 measures the patient’s SpO2 and displays:

• Pulse rate (PR) value in the parameters area.

• PLETH waveform and pulse intensity (perfusion indicator) in the channels area.

• Oxygen saturation (SpO2 %) value in the parameters area.

As the following illustration shows, the perfusion indicator (relative to the pulse intensity) is located on the left side of the PLETH waveform while the measured SpO2 value on the right. The SpO2 value is displayed by percentage. The SpO2 title in the parameters area allows you to access the SpO2 menu.



The PR value is displayed in the parameters area only if:

1. SpO2 is selected in the HR Source menu; or
2. Auto is selected in the HR Source menu and the received ECG signal is bad.

WARNING:

- The L550 can overestimate the SpO2 value in the presence of Hb-CO, Met-Hb or dye dilution chemicals.
- ES (electrosurgery) equipment wire and SpO2 cable must not be tangled up. Carefully route patient cabling to reduce the possibility of patient entanglement or strangulation.
- Do not use the L550 and the sensors during magnetic resonance imaging (MRI). Induced current could potentially cause burns. The L550 may affect the MRI image, and the MRI unit may affect the accuracy of the oximetry measurements.
- Do not put the SpO2 sensor on the limb with arterial catheter or venous syringe.
- Do not perform SpO2 monitoring and NIBP measurements on the same arm simultaneously. Obstruction of blood flow during NIBP measurements may adversely affect the reading of the SpO2 value.
- Before performing the testing, check the sensor cable. After unplugging the SpO2 sensor cable from the socket, the system should display the flashing prompt information “Sensor Off” above the PLETH waveform.
- Prolonged and continuous monitoring may increase the risk of burns at the site of the sensor. It is especially important to check the sensor placement, and ensure proper attachment on neonates and patients of poor perfusion or skin sensitive to light. Check the sensor location every 2-3 hours and move to another location if the skin deteriorates. More frequent examinations may be required for different patients.

NOTE: Place the SpO2 sensor cable at the backside of the patient hand. Make sure the fingernail is just opposite to the light emitted from the sensor.

MONITORING PROCEDURE

Follow the procedure as below:

1. Power on the L550.

2. Attach the sensor to the proper site on the patient.

3. Plug the connector of the sensor extension cable into the SpO2 connector on L550.

The process of SpO2 plethysmogram measurement is generally the same. But the SpO2 sensor selection and placement depend on the patient type. When choosing a site for a sensor, refer to the directions for that sensor.

MEASUREMENT LIMITATIONS

If the accuracy of any measurement does not seem reasonable, first check the patient's vital signs by an alternate method. Then check the instrument for proper function. Inaccurate measurements may be caused by:

- Incorrect sensor application or use;
- Placement of a sensor on the same extremity with a blood pressure cuff, arterial catheter, or intravascular line;
- Exposure to excessive illumination, such as surgical lamps (especially ones with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight (exposure to excessive illumination can be corrected by covering the sensor with a dark material);
- Excessive patient motion;
- Venous pulsations;
- Intravascular dyes such as indocyanine green or methylene blue;
- Defibrillation;

Other physiological conditions or medical procedures that may interfere with the L550's measurements include significant levels of dysfunctional haemoglobin, low perfusion, and dark pigment.

Loss of pulse signal can occur in the following situations:

- The sensor is too tight;
- A blood pressure cuff is inflated on the same extremity as the one with a SpO2 sensor attached;
- There is arterial occlusion proximal to the sensor.

Select an appropriate sensor, apply it as directed, and observe all warnings and cautions presented in the directions for use accompanying the sensor. Clean and remove any substances such as nail polish from the application site. Periodically check to ensure that the sensor remains properly positioned on the patient.

If patient movement presents a problem, try one or more of the following remedies to correct the problem.

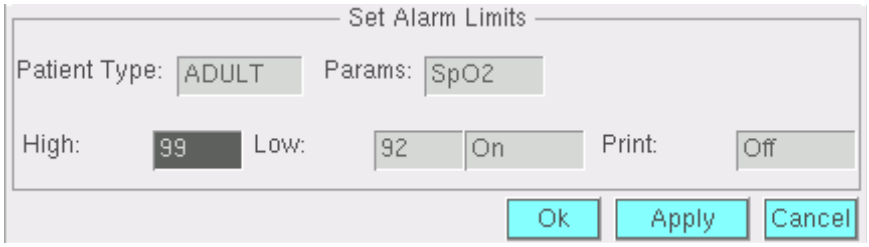
- Verify that the sensor is properly and securely applied.
- Move the sensor to a less active site.

MENU

SpO2 MENU

Selecting the SpO2 title in the parameters area displays the following menu:

- Alarm On/Off: Enables or disables the SpO2 alarm.
  - Alarms enabled: The SpO2 alarm is turned on and the monitor alarms when the measured SpO2 value exceeds the preset alarm limit.
  - Alarms disabled: The ✖ icon is displayed on the left side of the SpO2 title, the SpO2 alarm is turned off, and the monitor does not generate alarms when the measured SpO2 value exceeds the preset alarm limit.
- Alarm Setting: Selecting this button displays the following Set Alarm Limits dialogue box.



The upper alarm limit, lower alarm limit, alarm switch and alarm printing switch of SpO2 can be set in this dialogue box. See ALARM SETTINGS in CHAPTER 5 for detailed information.

- AVRG.: Select this button, the following menu is displayed:

The average period for SpO2 calculation can be set in this menu.

4 Beats: The average period is 4 SpO2 periods.

8 Beats: The average period is 8 SpO2 periods.

16 Beats: The average period is 16 SpO2 periods.

WARNING: Setting the SpO2 upper alarm limit to 100% will disable the upper alarm limit. High oxygen levels may predispose a premature infant to retrolental fibroplasia. Therefore, the upper alarm limit for oxygen saturation must be carefully selected in accordance with the commonly accepted clinical practices.

PLETH MENU

Selecting the PLETH channel title displays the following menu:

Fill Waveform: Fills or unfills the PLETH waveform. It has the same function as the Pleth fill button in the *Display* menu.

MAINTENANCE AND CLEANING

NOTE:

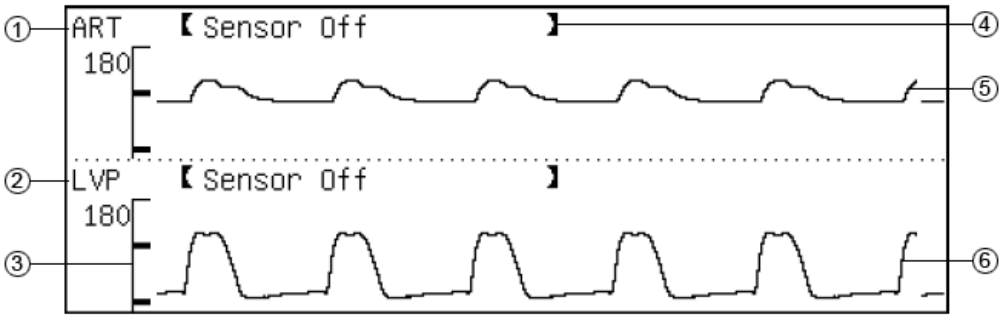
Clean the sensor and the surface of the probe before and after each use. You can wipe surfaces with 70% • Isopropylic Alcohol or soak the clip for five minutes in Isopropylic alcohol. After soaking the clip, it must be rinsed with water and air-dried prior its use.

SpO2 sensor must be recycled or disposed of properly, complying with the local laws.

15. IBP MONITORING

IBP CHANNELS

The L550 provides two channels to measure invasive blood pressure (IBP), including systolic, diastolic and mean pressures, and displays two waveform channels and two parameters. The two channels of waveforms are differentiated by colour. When two curves overlap, the curve colour is that of channel 2.



① Channel 1 title: selecting this displays the menu of channel 1.

② Channel 2 title: selecting this displays the menu of channel 2.

③ Pressure axis: It is the pressure axis of the waveform displayed to its right.

The lower horizontal line indicates the position of zero pressure. If a curve point is higher than this line, indicates a positive pressure; lower than this line is negative.

The upper horizontal line indicates the maximum pressure of current display gain. A pressure higher than the maximum pressure, clips the curve.

The height of the waveforms relates to the pressure. The ratio between height and pressure is specified. Maximum and minimum values are listed as follows:

Maximum (mmHg)	6	10	18	30	60	80	100	120	180	240	300
Minimum (mmHg)	-1	-1	-2	-3	-6	-8	-11	-13	-20	-26	-33

The L550 automatically selects a suitable ratio according to the phase of the waveform in AUTO mode. The ratio can be adjusted manually in MANUAL mode.

④ Status message: All possible status messages are listed below:

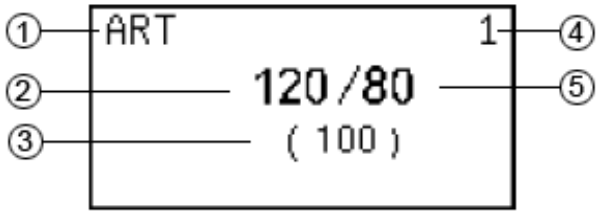
Message	**Cause**	**Solution**
No response	The monitor cannot get data from this channel	During start up, this message indicates that the channel has not yet started. If this message does not disappear after 5 seconds, the IBP module may be faulty.
Sensor off	The pressure sensor isn't connected to the monitor.	The pressure sensor cable has fallen off from the monitor or from the pressure sensor.
NOT zero	The channel wasn't zeroed	Zero the monitor after it is started, else the measured pressure is unreliable.
Auto/manual	Displays the current gain mode and gain ratio.	N/A

⑤ Channel 1 waveform.

⑥ Channel 2 waveform.

IBP PARAMETER

The measured IBP values of two channels are displayed in the parameters area, the right side of the IBP channels, as shown below:



① IBP title of channel 1

② Systolic blood pressure (SYS)

③ Mean pressure (MEAN)

④ Indicates that this area displays the measured IBP values of channel 1

⑤ Diastolic blood pressure (DIA)

IBP values can vary in the range from -60mmHg to 300mmHg. Values not in this range are displayed as invalid pressure, in the form "---" or "--.-".

Other reasons that pressure values are displayed as invalid values are:

1. The actual pressure is not in the range from -60 mmHg to 300 mmHg.
2. The channel wasn't zeroed.
3. The cable is disconnected or not connected firmly.
4. The channel is not calibrated properly.
5. Zero processing is underway.
6. Monitor is starting.

The IBP unit is the same as the NIBP unit.

WARNING:

- Use only the IBP transducer specified in this manual. Disposable IBP transducers should not be reused.
- Parts and accessories used must meet the safety requirements of the medical electrical equipment standards.
- Avoid conductive connection to the applied part likely to degrade safety.
- When the L550 is used with high frequency surgical equipment, do not allow the transducer and the cable contact the high frequency surgical equipment to prevent the patient from burning caused by leakage current.

MONITORING PROCEDURE

1. Plug the pressure cable into the IBP connector on the L550 and power on.

2. Prepare the pressure line and transducer by flushing the system with normal saline solution. Make sure the tubing and transducer system is free of air bubbles.

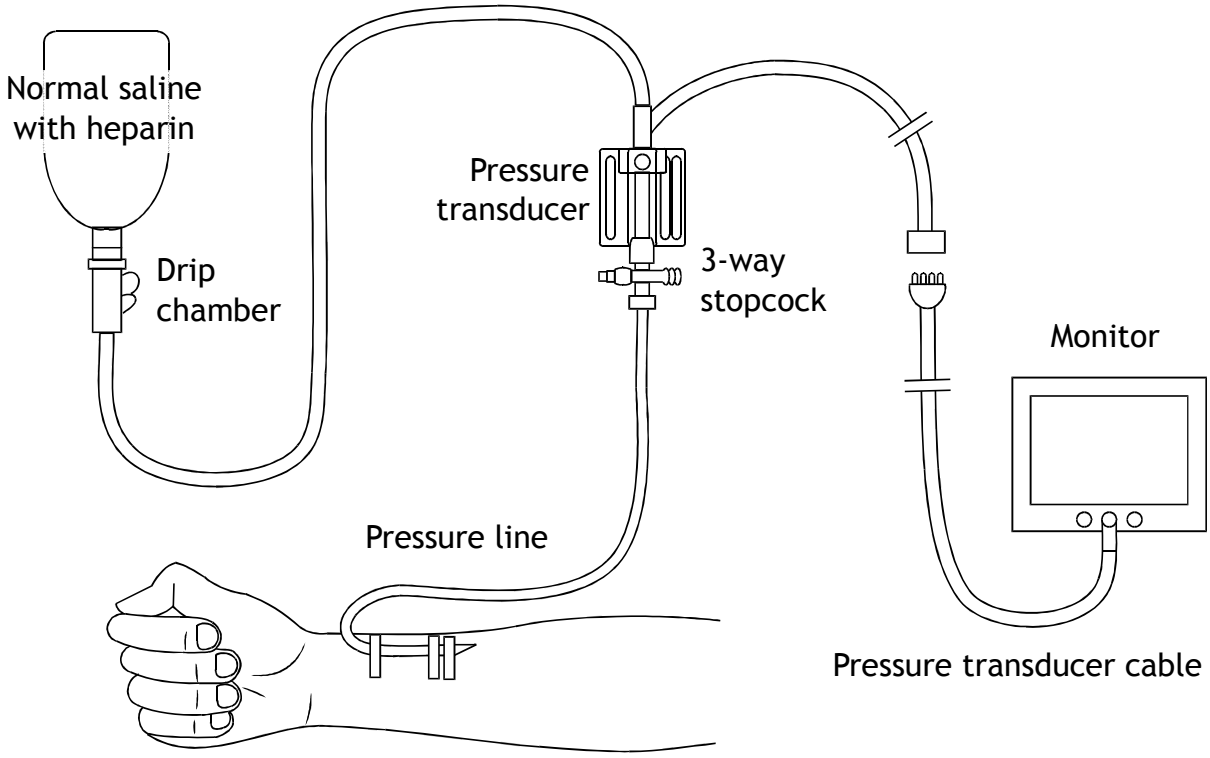
NOTE: In case of any air in the pressure system, re-fill the system with normal saline.

3. Connect the catheter to the pressure line, making sure there is no air present in the catheter or pressure line.

4. Position the transducer so it is at the same level with the patient's heart, approximately mid-axillary line.

5. Verify the correct title is selected.

6. Zero the transducer.

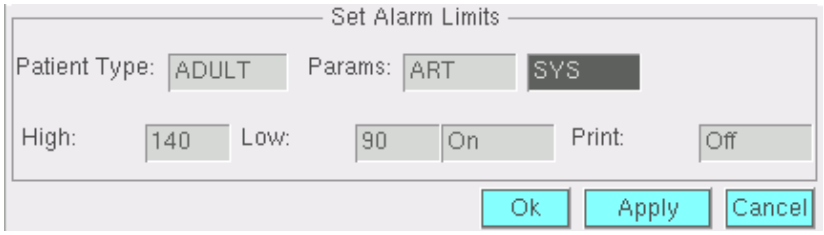


IBP MENU

IBP PARAMETER MENU

Selecting the IBP parameter title in the parameters area displays the following menu is displayed:

- Alarm On/Off: Enables or disables the IBP alarm (including systolic, diastolic and mean pressure alarms).
  - Alarm enabled: The IBP alarm is turned on, the monitor alarms when the measured IBP value exceeds the preset alarm limit.
  - Alarm disabled: The ✖ icon is displayed to the left of the IBP parameter title, the IBP alarm is turned off, and the monitor does not generate alarms when the measured IBP value exceeds the preset alarm limit.
- Alarm Setting: Selecting this button pops up the following *Set Alarm Limits* dialogue box:



  The upper alarm limits, lower alarm limits, alarm switches and alarm printing switches of SYS, DIA and MEAN can be set in this dialogue box.

- Label: Selecting this button switches the label (title) of this channel. The title cycles through the order listed below:

Label	Definition
ART	Arterial blood pressure
CVP	Central venous pressure
RVP	Right ventricle pressure
LAP	Left atria pressure
RAP	Right atria pressure
PAP	Pulmonary arterial pressure
ICP	Intracranial pressure
LVP	Left ventricle pressure

The selected title will be saved in 5 seconds and displayed in the corresponding channel. It does not take any other effect other than displaying.

IBP CHANNEL MENU

Select the title of a target IBP channel, and the menu of this channel is displayed, as shown below: In this menu, the user can change the title of the channel, zero the transducer and select the display gain.

Label

This has the same function as the Label button in the IBP parameter menu. Selecting this button switches the label (title) of this channel.

Zero

Press this button and the corresponding channel will perform the zeroing process. Selecting this button again will terminate the zeroing. The system treats the detected absolute pressure value as the relative zero point. This zero point affects both the pressure values and the waveforms of the channel.

Zeroing procedure:

1. Disconnect the transducer from the patient.
2. Adjust the 3-way stopcock to close the channel leading to the patient. The transducer is open to atmosphere through the stopcock.
3. Select the Zero button in the IBP channel menu to start zeroing.

NOTE:

- The zeroing function is not effective in "sensor off" status. It is effective only when the sensor is connected to the monitor.
- Position the transducer at the same level as the patient’s heart, approximately at the mid-axillary line.
- Perform pressure zeroing when the monitor is powered on and at measuring intervals (at least once per day). Zeroing should also be conducted if the transducer cable or catheter is changed.
- Where possible, prevent catheter movement as zeroing is completed quicker.

Gain Mode

This button is to select the display gain mode for the channel. The gain mode switches between ‘Auto’ and ‘Manual’ when selecting this button. This function is disabled if the channel wasn’t zeroed.

Adjust Gain

If the gain mode of the channel is manual, the user can use this button to increase/decrease display gain. Turning clockwise to decrease, and anti-clockwise for increase. This operation zooms in the waveform in vertical direction. This function is also disabled if the channel wasn’t zeroed.

MAINTENANCE AND CLEANING

WARNING: Before cleaning the transducer, make sure the transducer is disconnected from the L550, or the L550 is powered off and disconnected from AC power.

CLEANING OF IBP TRANSDUCER

After the IBP monitoring operation is completed, remove the tubing and the dome from the transducer and wipe the transducer diaphragm with water. To clean the transducer and the cable, wipe them using soap or the detergents listed below:

- Cetylcide
- Wavicide-01
- Wescodyne
- Cidex
- Lysol
- Vesphene

Do not immerse the connector in any liquid. After cleaning, dry the transducer thoroughly before storing. Slight discolouration or temporary increase of surface stickiness of the cable may occur. If it is necessary to remove the adhesive tape residue from the transducer cable, use removal substances with caution to minimize damage to the cable. Acetone, Alcohol, Ammonia and Chloroform, or other strong solvents are not recommended because they are harmful to the vinyl cabling if used for a long time.

NOTE

- The disposable transducers or domes must not be reused.
- To avoid contamination, the disposable transducers or domes must be reclaimed or disposed of properly, complying with the local laws.

STERILIZATION

Chemical Solution Sterilization

After cleaning, select an effective sterilising chemical solution for sterilisation of the operating room equipment. Buffered glutaraldehyde (e.g. Cidex or Hospisept) is recommended. Do not use quaternary cationic detergents such as Zephiran chloride. If the whole unit is to be sterilized, immerse the transducer but not the electrical connector into the sterilant for the recommended period. Ensure that the dome has been removed. Then rinse all transducer parts except the electrical connector with sterilized water or saline. The transducer must be thoroughly dried.

Gas Sterilization

For more complete asepsis, use gas sterilization. The transducer should be completely dry after cleaning. When ethylene oxide gas is used as the gas disinfectant, follow the operating instructions provided by the manufacturer of the gas disinfectant.

NOTE: The disinfectant temperature must not exceed 70°C (158°F). Plastics in the pressure transducer may deform or melt above this temperature.

16. CO2 MONITORING

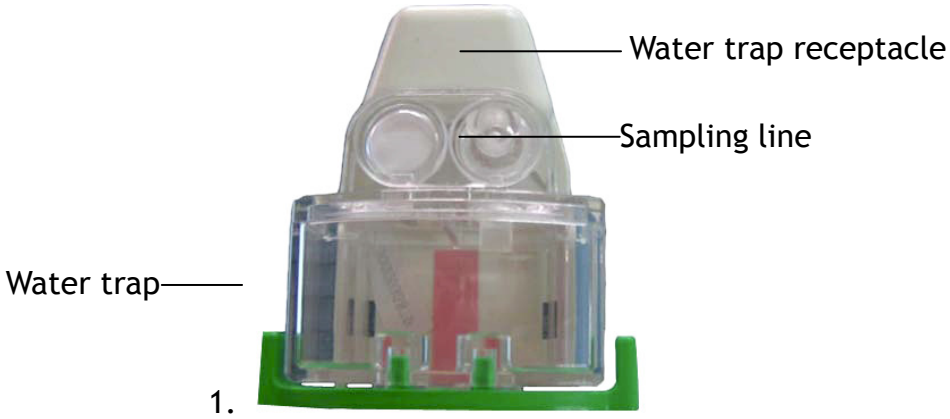
INTRODUCTION

CO2 monitoring detects the concentration of CO2 generated during patient respiration. The maximum concentration of CO2 at the end of exhalation is called end-tidal CO2 (EtCO2). The minimum concentration of CO2 at the end of inspiration is called fractional inspiratory CO2 (FiCO2). CO2 is generated by cells in the body during metabolism, and is exhaled via the respiratory system. The concentration of CO2 exhaled from the lungs reflects directly to metabolism and the respiratory system. If the CO2 concentration is high, it means that metabolizing is excited, such as blood poisoning or acute fever. If the CO2 concentration is low, it is usually because of weak heart output, the heart has stopped beating, lung function is abnormal or oxygen saturation is low. Monitoring CO2 is used to warn the doctor of abnormality of breathing and metabolizing of the patient.

The concentration of CO2 is represented as a pressure level, with mmHg, kPa or % as its unit. Generally, the acceptable value is 38mmHg (5.1kPa or 5%) when air pressure is 760mmHg. The concentration of CO2 varies very fast from 0% to 5% normally. To detect the concentration of CO2 accurately, the L550 has to be very sensitive.

MONITORING PROCEDURE

1. Plug the dehydration container into its receptacle and then push the bottom carefully into position, as shown below:



1.

2. Connect one end of the sampling line to the dehydration container.
3. Connect the other end of the sampling line to the patient.
4. Power on the L550.
5. Enable the CO2 channel via the Format Setup button in the display menu.
6. Select the Start Pump button in the CO2 channel menu to start air pump.
7. CO2 monitoring starts.

NOTE:

To monitor CO2, the CO2 channel and the air pump must be enabled. If the monitor is using default settings, these two items must be reset.

When there is no CO2 monitoring, disable the CO2 channel and air pump to prolong

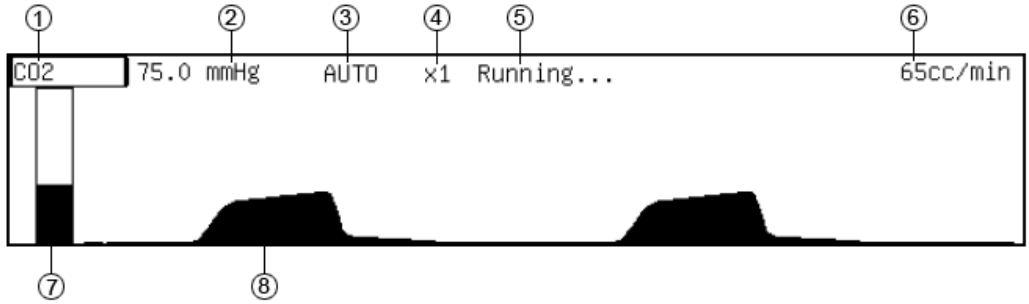
their service life.

MONITORING INTERFACE

The CO2 monitoring displays a CO2 waveform in the channel area and the measured EtCO2 and FiCO2 values in the parameters area.

CO2 CHANNEL

The CO2 channel is displayed as below:



① CO2 channel title

② Concentration unit

③ Gain mode

④ Gain

⑤ Prompt information

⑥ Flow rate

⑦ Scale

⑧ CO2 waveform

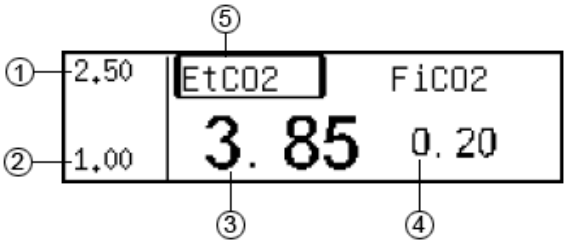
Selecting the CO2 channel title displays the following menu:

- Gain Mode: Switches the gain mode of the CO2 waveform between AUTO and MANUAL.
- Adjust Gain: Only available in MANUAL mode. Select this button then turn the rotary controller to adjust the gain. Five rates are available: ×1/2, ×1, ×2, ×4 and ×8. Press the rotary controller to select the gain rate.
- Flow Rate: Adjusts the flow rate of the CO2. Three rates are available: 65cc/min, 100cc/min and 150cc/min.
- Waveform Speed: Switches the waveform speed between 6.25mm/s, 12.5mm/s, 25mm/s and 50mm/s. It is the same as the RESP waveform speed, and changing it will switch the other one simultaneously. The current CO2 waveform speed can be viewed in the prompt information bar of the RESP channel.
- Concent. Unit: Switches the concentration unit between mmHg, kPa and %.
- Start Pump: Starts or stops the air pump. If the air pump is stopped, this button is

displayed as 'Start Pump', select it to start the air pump; if the air pump is started, this button is displayed as 'Stop Pump', select it to stop the air pump.

CO2 PARAMETER

The measured CO2 values are displayed as below:



① Upper alarm limit of EtCO2.

② Lower alarm limit of EtCO2.

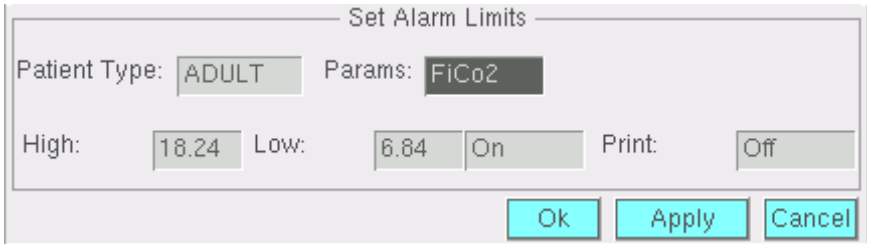
③ Measured EtCO2 value.

④ Measured FiCO2 value.

⑤ EtCO2 title.

Selecting the EtCO2 title displays the following menu:

- Alarm On/Off: Enables or disables the CO2 (EtCO2 and FiCO2) alarm.
    - Alarm enabled: The CO2 alarm is turned on, the L550 alarms when the measured EtCO2 or FiCO2 value exceeds the preset alarm limit.
    - Alarm disabled: The ✖ icon is displayed on the left side of the EtCO2 title, the CO2 alarm is turned off, and the monitor does not generate alarms when the measured EtCO2 or FiCO2 value exceeds the preset alarm limit.
- Alarm Settings: Displays the following 'Set Alarm Limits' dialogue box.



The upper alarm limits, lower alarm limits, alarm switches and alarm printing switches of EtCO2 and FiCO2 can be set in this dialogue box.

- Concent. Unit: Switches the concentration unit between mmHg, kPa and %.

MAINTENANCE AND CLEANING

If there is a problem with the sampling system of the CO2 module, check that the sampling line is not tangled. If the sampling line is not tangled, remove the dehydration vase and check for blockages. If blocked, replace it. If the dehydration vase is not blocked, the sampling line may be blocked. Replace it.

WARNING

- The sampling line is disposable and must not re-sterilised or reused.
- Do not press, fold or limit the sampling line.
- The dehydration vase is used to collect water drops condensed in the sampling airway and prevent water drops from entering the module. When the collected water fills the vase, empty the water to avoid blocking the airway.
- In the long-term use, dust or other substances may lower the air permeability of the filter material in the dehydration vase and may block the airway. It is advised changing the dehydration vase.

NOTE: The sampling line must be recycled or disposed of properly, complying with the local laws.

17. MAINTENANCE

WARNING: Do not open the monitor housing as equipment failure and possible health hazards may be caused.

INSPECTION

After servicing or a system upgrade, or after 6-12 consecutive months use, make sure a complete inspection is completed by qualified service personnel before putting the L550 into operation to ensure normal operation of the system.

Follow these guidelines when inspecting the equipment:

- The environment and the power supply meet the specified requirements.
- Inspect the buttons, rotary controller, connectors and accessories for damage.
- Inspect the power cords for fraying or other damage and check the insulation.
- Check the grounding cables are correctly connected.
- Only specified accessories such as electrodes, sensors and probes are used.
- The monitor clock is correct.
- The audible and visual alarms function normally.
- The recorder functions normally and the recorder paper meets requirements.

If there is any damage or any above guidelines are not met, do not use the L550.

CLEANING

WARNING: Be sure to shut down the system and disconnect all power cords from the outlet before cleaning the equipment.

The L550 and its accessories should be cleaned on a regular basis. If there is heavy soiling or lots of dust or dirt in the operating environment, the equipment should be cleaned more frequently. Before cleaning the equipment, consult your hospital's regulations for cleaning, disinfecting and sterilizing equipment.

The exterior surfaces of the equipment may be cleaned with a clean and soft cloth, or sponge, dampened with a noncorrosive cleaning solution. Drying off excess cleaning solution before cleaning the equipment is recommended.

Suitable cleaning solutions:

- Diluted soap water
- Diluted ammonia water
- Diluted sodium hyoichlo (bleaching agent)
- Diluted formaldehyde (35 to 37%)
- Hydrogen peroxide (3%)
- Ethanol (70%), or Isopropanol (70%)

NOTE: To avoid damage to the equipment,

- ALWAYS dilute solutions according to the manufacturer’s instructions.
- ALWAYS wipe off all cleaning solution with a dry cloth after cleaning.
- NEVER pour or spray water or any cleaning solution on the equipment or submerge the equipment into water or any cleaning solution.
- NEVER allow fluids to run into the casing, switches, connectors, or any ventilation openings in the equipment.
- NEVER use abrasive cleaners, or cleaners containing acetone.

Failure to follow these steps may damage the casing, labels, or cause equipment failure.

For cleaning information of accessories, please refer to the chapters for specific patient parameters and the instructions for use of the accessories.

DISINFECTION AND STERILIZATION

Sterilization or disinfection may cause damage to the equipment. We recommend that sterilization and disinfection of this equipment limited by the hospital’s servicing schedule as "only when necessary".

The equipment should be cleaned prior to sterilization and disinfection.

Recommended sterilization material: Alcohol-based (ethanol 70%, isopropanol 70%), or aldehyde-based.

WARNING

- Disinfection or sterilization may cause damage to the equipment; therefore, when preparing to disinfect or sterilize the equipment, consult your hospital’s infection controllers.
- DARAY Ltd can not be held responsible for the effectiveness of the end-user's disinfection/sterilization method to control infection.

NOTE

- ALWAYS dilute the solutions according to the manufacturer’s suggestions and adopt a lower concentration if possible.
- NEVER submerge the equipment into water or any solution, or pour water or any solution on the equipment.
- ALWAYS wipe off all excess liquids on the equipment and accessory surfaces with a dry cloth.
- Never use EtO or formaldehyde to disinfect.
- Never allow high-pressure or high-temperature disinfection of the equipment and its accessories.

18. LABELS, PACKAGING, TRANSPORT AND STORAGE

LABELS

There are four symbols on the packing case:

 This way up

 Fragile, handle with care

 Keep dry

 Stack no more than four layers

PACKAGING

The L550 is sealed in a plastic bag and then put in the packing case that is filled with sponge or foam.

TRANSPORT

The L550 can be transported by aircraft, train or automobile. It has to be prevented from strong collision and being placed with corrosive substance.

STORING

The packed L550 should be stored at a temperature between -20°C to 50°C with a relative humidity no greater than 85% in a noncorrosive gas in a well-ventilated room.

PRODUCT SPECIFICATION

ENVIRONMENTAL SPECIFICATIONS

Operating

Temperature	5°C - 40°C
Relative humidity	≤80%
Air pressure	70 to 106 kPa

Transport and storage

Temperature	-20 to 55°C
Relative humidity	≤93%
Air pressure	50 to 106 kPa

POWER SOURCE SPECIFICATIONS

AC mains

Input voltage	100 to 240 V
Frequency	50/60 Hz
Power	80 VA
Fuse	T1.6 AL, 250 V, 20 x 5
Operating time	≥8 hours

Internal battery

Number of batteries	1
Type	Lead-acid or lithium-ion
Lead-acid battery	
Normal voltage	12 V
Capacity	2400 mAh
Operating time	>1 hour (with the battery fully charged and the monitor measuring every 10 minutes)
Charge time	6 hours

HARDWARE SPECIFICATIONS

Display

Type	Colour TFT LCD
Size	12.1" (diagonal)
Resolution	800 x 600 pixels

LED indicator

Alarm indicator	1 (red)
Power indicator	1 (green)
Charge indicator	1 (green)
Controls	
Knobs	3 (rotary controller, brightness and volume)
Buttons	7 (power switch, mute button, alarm button, freeze button, NIBP button, print button and main menu button)
Audio device	
Speaker	Gives audio alarms, heart beat tones, pulse tones and prompt tones for incorrect operation
Connectors	
Power supply	1 AC power connector
Parameter measurement	ECG, RESP, NIBP, SpO2, TEMP1, TEMP2, IBP1, IBP2, CO2
	1 RJ45 network connector
	1 VGA monitor connector
	1 recorder connector
	1 equipotential earth connector

DATA STORAGE

Trend data	≥24 hours
Waveform freezing	All the waveforms displayed in the channel area can be stored.

ECG SPECIFICATIONS

Lead type	3-lead: I, II and III 5-lead: I, II, III, aVR, aVL, aVF and V
Lead naming style	AHA
Noise level	≤30 μV
Frequency response	Filter mode: 1 to 25 Hz Non-filter mode: 0.5 to 75 Hz
Input offset current	≤0.1 μA
Sensitivity selection	2.5 mm/mV (x1/4) 5 mm/mV (x1/2) 10 mm/mV (x1) 20 mm/mV (x2) 40 mm/mV (x4) AUTO
Sweep speed	6.25 mm/s, 12.5 mm/s, 25 mm/s and 50 mm/s
Display linearity	Corresponding to ±15 mm of the vertical axis centre, the error should be less than ±10%
Input impedance	≥5 MΩ
Common mode rejection	≥60 dB
Time constant	Monitoring lead: ≥0.3 s Standard ECG lead: ≥3.2 s
Accuracy of standard signal	1 mV ± 5 %
Display stability	
Time excursion	The excursion after electrified for 60min is not greater than 5mm from the initial position which is the baseline position after electrified for 15min.
Temperature excursion	The average baseline excursion is not greater than 0.5mm/°C in the range from 5°C to 40°C
Voltage excursion	The baseline excursion is not greater than 1mm and the display sensitivity changes not greater than ±10% when the supply voltage fluctuates transiently
Polarized voltage	Corresponding to ±300mV polarizes DC voltage, the display sensitivity changes not greater than ±5%

Heart rate (HR)

Measurement range	15 to 300 BPM
Measurement precision	1 BPM or ±1%, whichever is greater

ST segment measurement

Measurement range	-0.8 to +0.8 mV
Measurement precision	±0.02 mV or ±5%, whichever is greater

RESP SPECIFICATIONS

Measurement technique	Thoracic impedance
Lead	Optional: lead I, II, III and default II

RR

Measurement range	0 to 120 BPM
Measurement precision	1 BPM or ±5%, whichever is greater
Alarm allowable deviation	±2 BPM or ±10%, whichever is greater

NIBP SPECIFICATIONS

Measurement technique	Oscillation
Displayed parameters	Systolic pressure, diastolic pressure and mean arterial pressure
Mode of operation	Manual, auto and continuous
Measurement interval in AUTO mode	2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 minutes and 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8 hours
Measurement time in CONTINUOUS mode	5 minutes
Measurement range	Systolic pressure (SYS): (4.0 to 36.0) kPa, or (30 to 270) mmHg Diastolic pressure (DIA): (1.3 to 26.7) kPa, or (10 to 200) mmHg Mean arterial pressure (MAP): (2.7 to 29.3) kPa, or (20 to 220) mmHg
Measurement precision	≤±0.4 kPa (3 mmHg) or ±2 %, whichever is greater
Alarm allowable deviation	±5%
Maximum standard deviation	5 mmHg

TEMP SPECIFICATIONS

No. of channels	2
Displayed parameters	T1, T2 and ΔT
Measurement range	25.0 to 45.0 ˚C
Measurement precision	±0.2 ˚C
Response time	≤2.5min
Alarm allowable deviation	± 2% ˚C

SpO2 SPECIFICATIONS

Measurement range	0 to 100%
Measurement precision	70 to 100%: ±2% 50 to 69%: ±3% 0 to 49%: unspecified
Alarm allowable deviation	±2%

PR SPECIFICATIONS

Measurement range	30 to 250 BPM
Measurement precision	1 BPM or ±2%, whichever is greater
Alarm allowable deviation	±10%

IBP SPECIFICATIONS

Number of channels	2
Pressure readings	Systolic pressure, diastolic pressure and mean pressure
Pressure labels	ART, CVP, RVP, LAP, RAP, PAP, ICP and LVP
Measurement range	-10 to 300 mmHg
Measurement precision	±0.133 kPa (1mmHg) or ±2%, whichever is greater

CO2 SPECIFICATIONS

Measurement technique	Infrared absorption technique
Displayed parameter	EtCO2, FiCO2 and RR
Measurement range	0 to 10%
Measurement precision	<5.0%: ±0.28 kPa (2mmHg) >5.0%: ±10% of the read value

Returns Policy

IMPORTANT!
Before returning your item, you must call us on 0844 375 9000

We want you to be completely satisfied with your purchase. If you need to return goods purchased from DARAY Ltd, please read the following information carefully.

The DARAY Ltd returns policy provides guidance on when you can return goods we have supplied, and what you can expect from us once you do. To see our detailed returns policy and procedure visit www.daray.co.uk/returns

TYPE OF RETURN	REMEDY
DAMAGED GOODS OR DOA* Goods which are physically damaged on delivery, or which do not function.	We must be notified within 24 hours of receipt.
GOODS DEVELOPING A FAULT Goods which have developed a fault within the warranty period.	Within 14 days of delivery we will replace the item as DOA*. If the fault develops after 14 days, but within the warranty period, we will initiate the returns procedure.
NON WARRANTY Goods which have developed a fault outside the warranty period.	If a fault develops outside the warranty period, we will initiate the returns procedure.
OTHER Any situation which is not covered by the above.	We will try to help, but we cannot normally offer a refund.

**DOA - dead on arrival*

For additional clarification, please refer to our terms and conditions at ***www.daray.co.uk/terms****.*

In a small number of cases, we may determine that a replacement would not work any better than the original product we supplied. In such cases we will only offer a refund rather than a replacement for qualifying returns.

Replacement bulbs are not eligible for returns, unless they are faulty or damaged.

Spare parts ordered on our website or from supplied part codes are not be eligible for credit. We will accept returns and exchange for the correct item.

If you purchase an item incorrectly you can return it within 14 days and it can be exchanged for another product of equal or high value, excluding transportation charges incurred.

If you send us goods that do not qualify for return, you will invalidate your claim to any refund, and you will be obliged to compensate DARAY Ltd for the cost of return postage and any other reasonable costs incurred processing the goods.

Your statutory rights are not affected.

WARRANTY

TERMS AND CONDITIONS OF WARRANTY

1. To qualify for this warranty you must register on *www.daray.co.uk* or return to Daray Ltd (Daray) the duly completed warranty-registration form accompanying the product.

2. Daray warrants this product (excluding lamp) against faulty material and workmanship during the period of the warranty. The period of warranty is the period stated on your warranty card and commences on the date of purchase of the product. In the event that the product is not in good working order Daray will provide, during the warranty period, a free repair service within the United Kingdom. The warranty is subject to proof of purchase being provided; therefore, you should retain your original receipt.

2.1 The repair service consists of the provision of spare parts and/or replacement products (at Daray's discretion) which will be provided on an exchange basis and will either be new, equivalent to new or reconditioned. All replaced spare parts and products shall become the property of Daray.

2.2 Daray's only obligation under this warranty is the provision of the service as set out above.

2.3 All products are returned to Daray at the customer's cost and risk. Products to be returned should be adequately packed. For the address to send returns to please visit *www.daray.co.uk*

3. Daray's arrangements for providing service provided under this warranty may include the use of sub-contractors.

4. This warranty does not cover damage or defects in the Product caused by or resulting from:

- Wilful neglect or negligence by anyone other than Daray;
- Improper use, storage or handling of the product;
- Use of non-Daray approved parts (such as replacement lamps) not compatible with the Product;
- Fire, accident or disaster;
- Use of non-Daray modifications other than in accordance with Daray's instructions;

Attachment of fittings and accessories not approved by Daray;

Repairs, modifications carried out by service personnel not approved by Daray;

- Damage caused by chemical corrosion from cleaning agents not approved by Daray.
- Failure to use or install the product in accordance with the manufacturer's instructions.

5. Nothing in this warranty shall have the effect of restricting or excluding the liability of Daray in respect of:

a) Death and personal injury caused by the negligence of Daray, or for fraud;

b) Under the *Consumer Protection Act 1987* to a person who has suffered damage caused by a defective product or to a dependant or relative of such a person;

c) Direct damage to your property caused by the proven negligence of Daray.

6. This agreement does not give any rights other than those expressly set out above and in particular, Daray will not be responsible for any loss of income, profits or contracts or any direct or indirect consequential loss, damage caused to or suffered by the purchaser as a direct result of this agreement.

7. This warranty is offered (subject to these terms and conditions) in addition to, and does not affect your statutory rights.

8. Daray may disclose your details and other personal information to companies within the Daray group including any subsidiary company or sub contractor of Daray for the purposes of performing our obligations hereunder.

9. You must not resell outside the UK any products supplied by Daray and covered by the *Export of Goods (Control) Order 1992* (or any law that replaces it) with out obtaining all necessary licences. You also agree not to sell the product in the UK if you know or think that the person buying the product intends to export it without getting the necessary licences. You agree to impose similar conditions to these on anyone you sell the product to.

10. These conditions shall in all respect be governed and construed in accordance with English law and the exclusive jurisdiction of the English courts.

DARAY®

WARRANTY REGISTRATION

TO VALIDATE YOUR WARRANTY
PLEASE COMPLETE IN BLOCK CAPITALS
AND RETURN IN A WINDOWED DL ENVELOPE
TO OUR FREEPOST ADDRESS

ALTERNATIVELY REGISTER ONLINE AT WWW.DARAY.COM

1 YEAR WARRANTY

NAME:

COMPANY:

EMAIL:

PHONE:

FAX:

ADDRESS:

PURCHASED FROM:

DATE OF PURCHASE:

Occasionally DARAY would like to send you information about our special offers and promotions. If you do not wish to receive such information, please tick here: ☐

Privacy statement: DARAY will not pass on your details to any third party.

Freepost Plus RRAS-YGXE-SLBC
Daray Ltd
Marquis Drive
SWADLINCOTE
DE12 6EJ

PRODUCT:

SERIAL No:

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