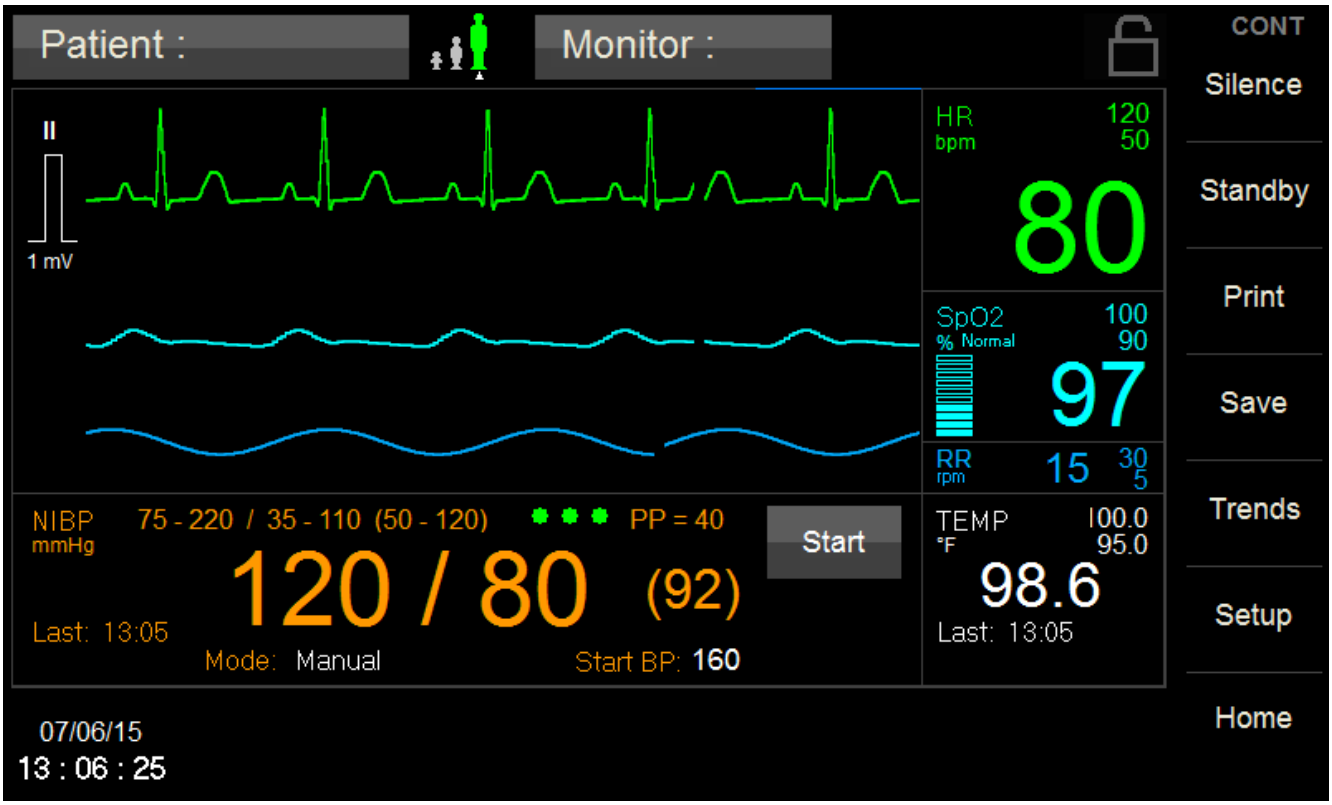
740 SELECT™



Multi-Parameter Monitor

User Manual Addendum - ECG & Resp Parameters

ZOE Medical

This User Manual Addendum describes the features and operations of the 740 SELECT Multi-Parameter monitor: Software Version 2.3 or above.

1. Overview

TRADEMARKS

Trademarked names appear throughout this document. Instead of inserting a trademark symbol with each mention of the trademarked name, the publisher states that it is using the names only for editorial purposes and to the benefit of the trademark owner with no intention of improperly using that trademark.

ZOE Medical is a registered trademark of Zoe Medical, Inc.

740 SELECT ™ is a trademark of Zoe Medical, Inc.

Refer to the 740 SELECT User Manual, Zoe Medical PN 21-22-0316, for a list of trademarks.

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CONVENTIONS USED IN THIS MANUAL

Warning: Directions that warn of conditions that put the patient or the caregiver at risk.

Caution: Directions that help to avoid damaging the **740 SELECT** monitor or losing data.

Note: Directions that make it easier to use the **740 SELECT** monitor.

IMPORTANT:

Read the 740 SELECT User Manual, Zoe Medical PN 21-22-0316 carefully before patient use of the Monitor.

This Manual addresses all optional ECG parameters of the 740 SELECT monitor.

Read this Manual carefully before patient use of the Monitor.

Zoe Medical reserves the right to make changes to this Manual and improvements to the product it describes at any time without notice or obligation.

REVISION HISTORY

This Manual has a revision number located at the bottom of each page. It changes whenever the Manual is updated.

Rev A	October 2015
Rev B	March 2019
Rev C	April 2020
Rev D	October 2021

WARRANTY

Refer to the **740 SELECT** User Manual, Zoe Medical PN 21-22-0316, for full Warranty Policy for Zoe Medical **740 SELECT** monitor. In all cases, policy applies from date of purchase from Zoe Medical or its authorized distributors or agents.

ECG Accessories:	Out-of-box failure only

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FIGURES

2. INTENDED USE

INTENDED USE

Full Indications for Use and Contraindications may be found in the 740 SELECT User Manual, Zoe Medical PN 21-22-0316.

The 740 SELECT monitor facilitates the monitoring of:

- ECG and heart rate (HR) with the ECG option for adult and pediatric patients;
- Impedance pneumography to detect respiration rate (RR) or absence of respiratory effort with the ECG option for adult, adolescent, child and infant patients.

The 740 SELECT monitor is a prescription device intended to be used by healthcare professionals in all areas of a healthcare facility.

OVERVIEW OF HEART RATE MONITORING

ECG Monitoring works through the sensing the electrical signals generated by the electrical activity of the heart as it beats. These signals are acquired from chest electrodes, and the 740 SELECT monitor amplifies the signals so they can be displayed on the screen. The patient's heart rate (HR) is calculated and continuously updated based on running average of the R to R intervals between each QRS complex.

The ECG and HR monitoring capabilities of the 740 SELECT monitor include:

- 3-wire cable monitoring capabilities
- Calculating the average heart rate (HR) in beats per minute
- Detecting asystole and ventricular fibrillation
- Pacer pulse detection
- Generating an audible pulse tone for each detected beat

OVERVIEW OF RESPIRATION RATE MONITORING

Respiration (Resp) monitoring works by measuring the impedance between the LL and RA electrodes (or the R and F electrodes for IEC lead designations). The impedance changes as the patient's chest expands and contracts during the breath cycle. To measure the changes in impedance, the **740 SELECT** monitor passes a very small, high-frequency current between the electrodes. This current is too small to cause any harm to the patient or any interference with ECG monitoring

The Respiration monitoring capabilities of the **740 SELECT** monitor include:

- Calculating the average Respiration Rate (RR) in respirations per minute
- Displaying the Respiration waveform continuously

The same electrodes are used for both ECG and Respiration monitoring.

Note: A **740 SELECT** monitor configured with capnography modules are also able to calculate RR from the CO_2 waveform. In this case the Resp/RR feature from ECG is disabled.

Refer to User Manual Addendum - $ETCO_2$ Parameter, Zoe Medical PN 21-22-0333 for more information.

PEDIATRIC CONSIDERATIONS

Cardiogenic artifact (heart rate pulsations that appear as "breaths" in the respiration signal) can be quite pronounced in Pediatric patients. This can cause the respiration rate to be artificially high (approaching the heart rate). To reduce cardiogenic artifact, move the White RA electrode (AHA lead designation) or the Red R electrode (IEC lead designation) from the right clavicle down to the right mid-clavical line, 4^{th} intercostal space.

3. ECG MONITORING

Note: The following Warnings and Cautions are directed toward the ECG monitoring function. Additional Warnings and Cautions for the 740 SELECT monitor are found in the 740 SELECT User Manual, Zoe Medical PN 21-22-0316.

WARNINGS

Warning: The monitor is not intended for use in the following cases:

- Apnea monitoring
- In an MRI environment
- Applications requiring automated arrhythmia detection
- Applications requiring diagnostic-quality ECG

Warning: – **DEFIBRILLATION**. To avoid the possibility of serious injury or death during patient defibrillation, do not come into contact with patient monitor or patient cables. Additionally, proper placement of defibrillator paddles in relation to the ECG electrodes is required to minimize harm to the patient. Only use accessories approved by Zoe Medical for use with the monitor.

Warning: **PACEMAKER PATIENTS**. Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon heart rate meter alarms. Keep pacemaker patients under close surveillance. See the Technical Data chapter for disclosure of the pacemaker pulse rejection capability of this instrument.

Warning: **PACEMAKER PATIENTS**. When Analyze Pacers is disabled, the Heart Rate may continue to count the pacemaker rate during occurrences of cardiac arrest. Keep pacemaker patients under close surveillance and do not rely entirely upon Heart Rate alarms.

Warning: **ELECTROSURGERY**. The monitor is suitable for use in the presence of electrosurgical (ESU) equipment. The following precautions should be taken:

- To minimize the risk of patient burns, only use ESU equipment that monitors the impedance of the ESU return wires.
- Users should be properly trained in the operation of the ESU equipment.
- Keep patient-applied cables (e.g., ECG lead wires) off of earth ground and away from the ESU knife and return wires to prevent burns to measurement sites.
- To prevent burns to the patient in the event of a defective neutral ECG electrode of the device, it is necessary to place ECG electrodes far from the neutral electrode, and as equidistant as possible from the blade-neutral axis of the surgical patient monitor.
- When activating the ESU device, the ECG signals may be distorted or may disappear, and Lead Fail or Noise alarms might be present. The signal should return once the ESU activation stops.
- When activating the device, using the SpO_2 parameter as the heart rate source rather than the ECG parameter to determine heart rate may be clinically preferred.
- Only use accessories approved by Zoe Medical for use with the monitor.

Warning: **ARRHYTHMIA PATIENTS**. The monitor is designed to operate in the presence of cardiac arrhythmias. However, the heart rate meter may be adversely affected in some cases.

Warning: Conductive parts of the ECG patient cables, electrodes, and associated connections of type CF applied parts, including the neutral conductor of the patient cable and electrode should not come into contact with other conductive parts including earth ground.

Warning: Read safety instructions provided with a defibrillator. The monitor is designed to withstand defibrillation and will recover within 5 seconds, per IEC 60601-1. Only use accessories approved by Zoe Medical for use with the monitor.

Warning: Operating the monitor with HR/PR limit alarms disabled means that no low or high HR/PR alarm conditions will produce alarm notifications. Use this feature with extreme caution. Patients must be closely observed if HR/PR limit alarms are disabled.

Warning: Care should be taken to ensure that the total patient-applied current across all patient-connected equipment is less than 10 microamperes (uA). The monitor applies approximately 2½ uA to the patient.

CAUTIONS

Caution: Line isolation monitor transients may resemble actual cardiac waveforms and thus inhibit heart rate alarms. To avoid the risk of this happening, follow the directions for proper electrode placement, and keep the ECG lead wires away from sources of line noise.

Caution: To avoid large offset potentials due to polarization of electrodes, be sure to use pregelled, Ag/AgCl disposable electrodes, and be sure that all electrodes used on a patient are of the same type.

NOTES

Note: The HR/PR numeric is displayed in green when sourced from ECG (default). The color changes to cyan or green respectively when sourced from SpO2.

Note: If an ECG waveform is not displayed, follow the instructions in the chapter GETTING STARTED WITH ECG to select the ECG waveforms for display.

Note: Visually inspect the ECG cables on a daily basis and follow the instructions in the Cleaning and Maintenance chapters as needed. Also, check for an inoperable ECG circuit which would manifest itself as a blank ECG waveform and a "HR lead off" message.

GETTING STARTED WITH ECG

To begin monitoring ECG, use the following procedure:

1. **Connect the ECG Patient Cable to the Monitor**

   Locate the ECG Patient Cable Receptacle on the side of the Monitor. Refer to Figure 1.

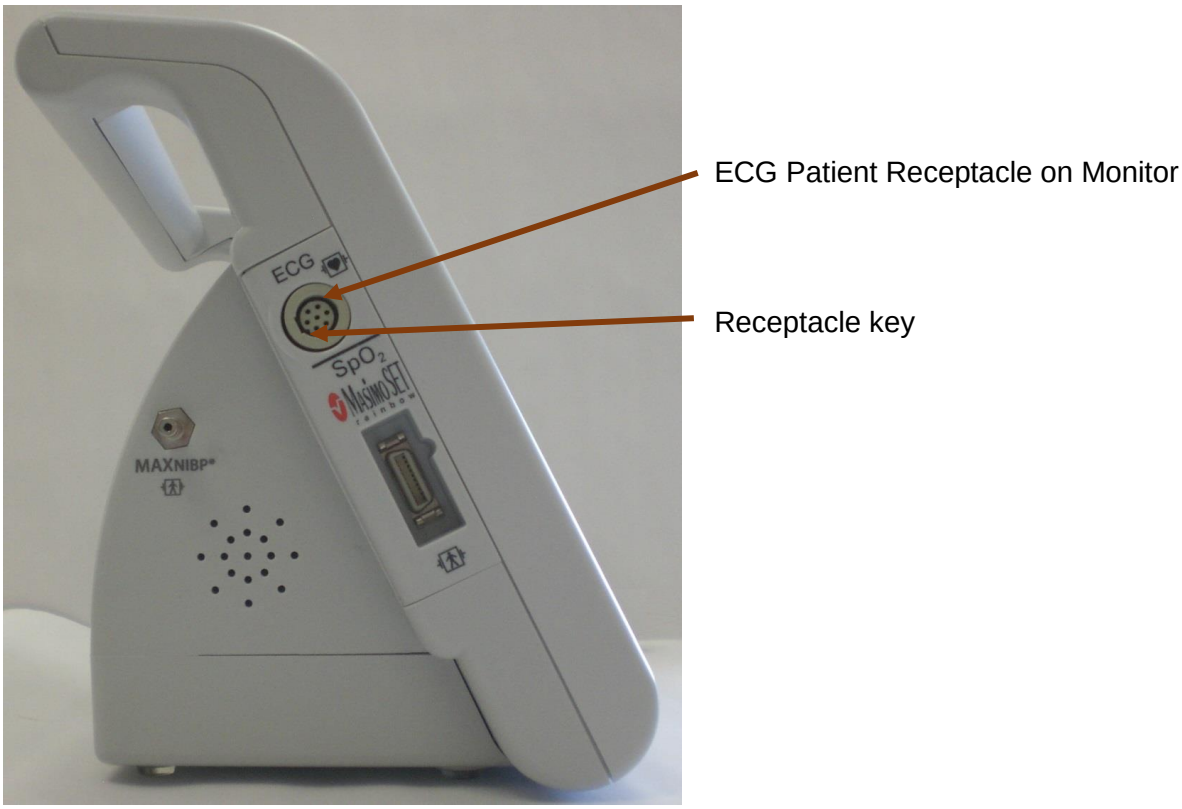

Figure 1: ECG Patient Cable Receptacle on left side of Monitor

Note: The ECG Receptacle is keyed so that the ECG Patient Cable can only be inserted into the monitor in one orientation. The key on the Receptacle is located towards rear of monitor.

Insert the ECG Patient Cable to the ECG Patient Cable Receptacle located on the on the left side of the Monitor. Refer to Figure 2.

Note: The ECG Receptacle is keyed so that the ECG Patient Cable can only be inserted into the monitor in one orientation. The key on the ECG Patient Cable Receptacle is located towards rear of monitor.

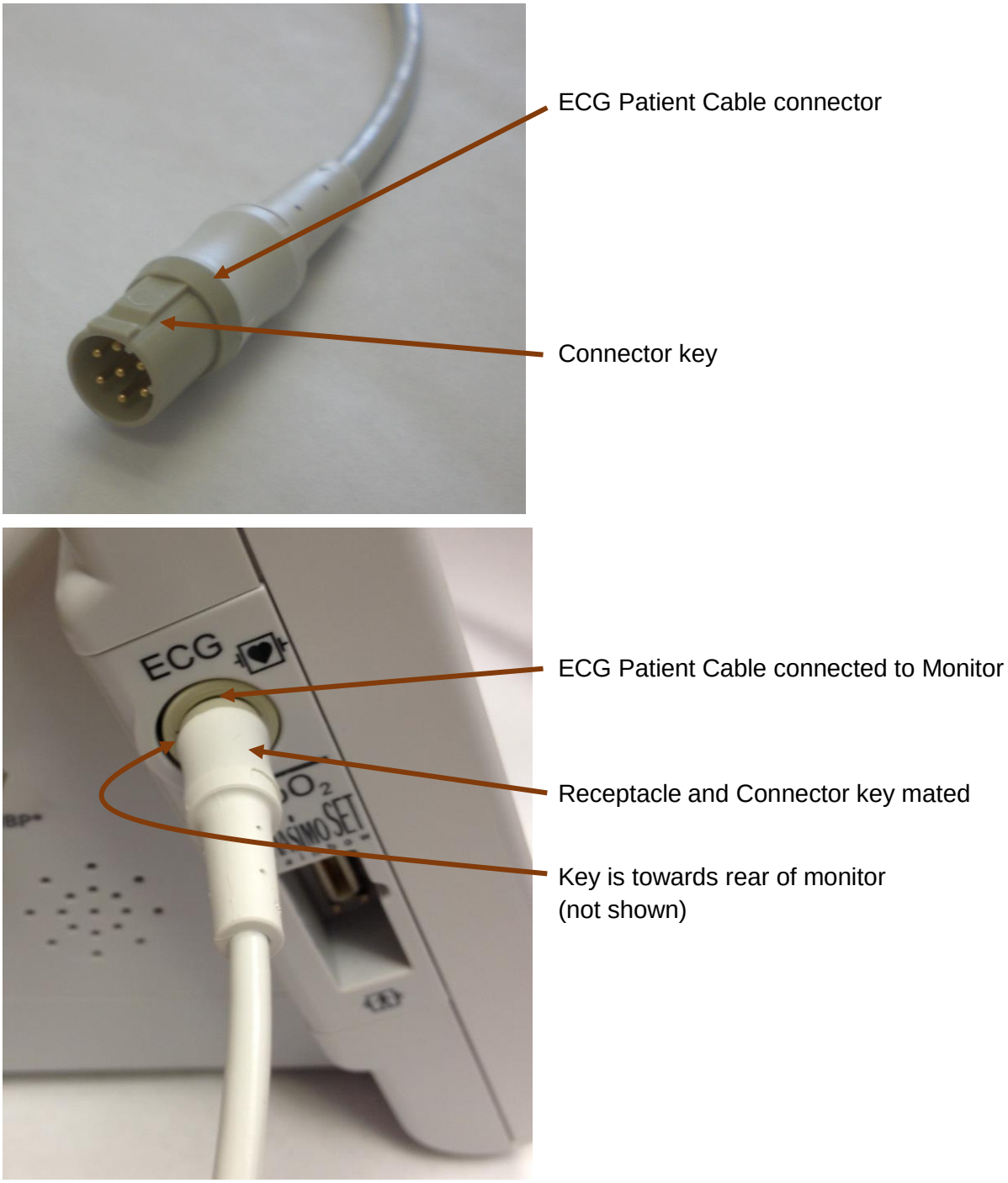

Figure 2: ECG Patient Cable connected on Monitor

2. **Connect the ECG Lead Set to ECG Patient Cable**

   Connect an appropriate ECG 3-Lead Set (1 meter length) to the ECG Patient Cable (2 meter length). ECG 3-Lead Sets are available in AAMI or IEC colors, snaps (adult/pediatric), or mini-clip (neo) lead sets that to attach to the ECG electrodes.

Note: The ECG Lead Set and ECG Patient Cable Yoke Receptacle are keyed so that they can only be inserted in one orientation. Refer to Figure 3.

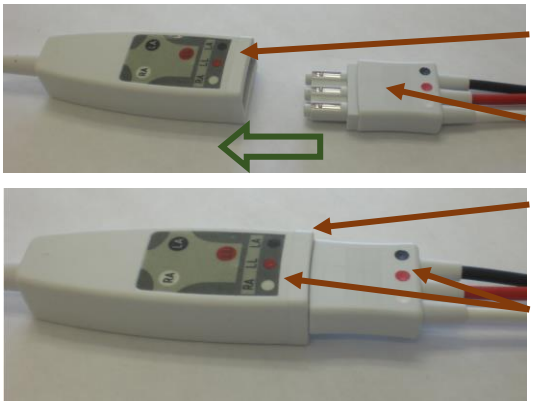

Figure 3: ECG Lead Set connected on ECG Patient Cable Yoke

Note: Once the ECG Lead Set and ECG Patient Cable are connected the colored dots on the Yoke and Lead Set should match. The label on the Yoke is also a quick guide to general electrode placement. Refer to the ELECTRODE PLACEMENT section for additional information for electrode placement.

3. **Select and prepare the electrodes.**

   Pregelled, Ag/AgCl disposable electrodes are recommend.

   Depending on the situation, you may want to use either the short-term (foam-backed) or long-term (cloth-backed) electrodes.

   Do not use electrodes after their expiration date, or if the gel has dried out.

4. **Prepare the patient's skin for applying the electrodes.**

   Getting a good quality ECG signal depends largely on how good the contact is between the electrodes and the patient's skin.

   To help assure this, you should first clip or shave any excess hair and remove any skin residue or oils using an alcohol pad.

   To reduce skin impedance, mildly abrade only the electrode contact site using ultrafine sandpaper (220-400 grit).

   For diaphoretic patients, use a benzoin prep to assure tighter adherence of the electrode.

5. **Apply the electrodes to the patient.**

   Apply the pad by using a circular motion on the adhesive area first, then pressing on the gel area gently, to avoid squeezing out the gel.

   Please refer to the diagrams on the following pages for guidance on proper electrode placement.

   You should change the electrodes every 24-48 hours to maintain a good quality ECG signal.

CHECKING THE ECG SIGNAL

When you have connected the patient following the steps listed above, you should be able to see a clean ECG signal similar to the Figure 4 below on the monitor display.

If the ECG contains artifact or noise, review the steps for proper electrode site preparation and placement (see following pages).

The Monitor should display a value for the patient's heart rate (HR) and alarm limit settings.

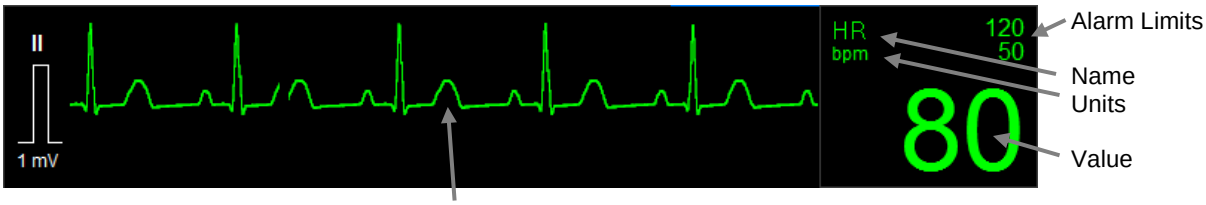

Figure 4: ECG Waveform section of Main screen

The ECG and Heart Rate Monitoring settings and specifications may be found in the SPECIFICATIONS chapter of this manual.

Procedures for changing configuration settings, such as sourcing pulse rate (PR) from SpO_2 while still displaying an ECG waveform, enabling a Pulse tone, displaying multiple ECG waveforms, or adjusting alarm limits, may be found in the ECG SETUP chapter.

The fixed square reference wave to the left of the ECG waveform indicates the height of a 1mV QRS associated for the current lead selection.

The size of the 1mV ref is dependent on ECG waveform Size selected

Another verification method is the ability to inject a 1 mV pulse on the ECG Waveform, refer to CAL PULSE under the HR PARAMETER SETUP Section, starting on page 24.

ELECTRODE PLACEMENT

STANDARD PLACEMENT (AHA)

For ECG cable lead sets with **AHA** (USA) lead designations, position the electrodes as shown in Figure 5 below:

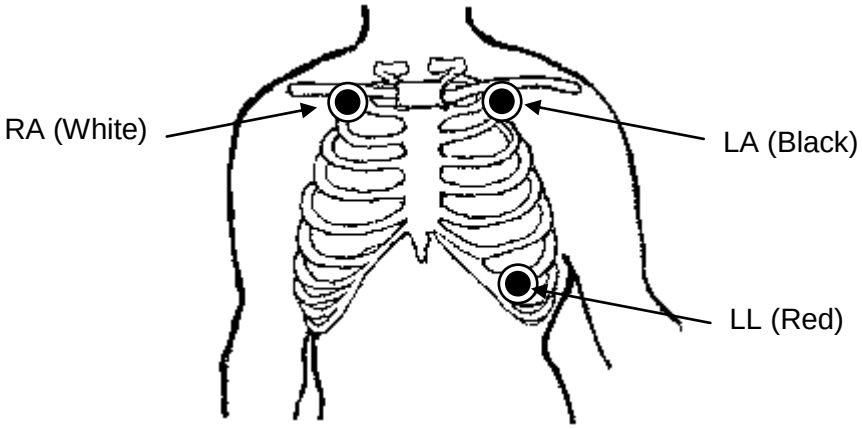

Figure 5: Standard **AHA** Electrode Placement

1. Position the right arm (RA) electrode on the right mid-clavicular line, directly below the clavicle.
2. Position the left arm (LA) electrode on the left mid-clavicular line, directly below the clavicle.
3. Position the left leg (LL) electrode on the left mid-clavicular line, 6th and 7th intercostal space.

STANDARD PLACEMENT (IEC)

For ECG cable lead sets with **IEC** (Europe) lead designations, position the electrodes as shown in Figure 6 below:

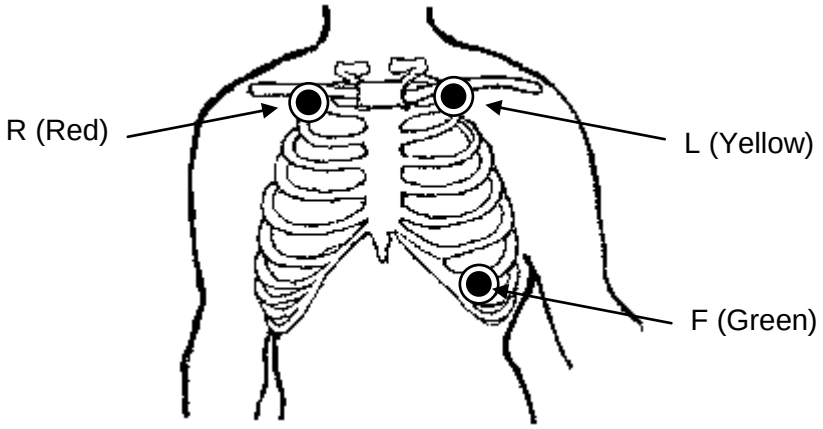

Figure 6: Standard **IEC** Electrode Placement

1. Position the right arm (R) electrode on the right mid-clavicular line, directly below the clavicle.
2. Position the left arm (L) electrode on the left mid-clavicular line, directly below the clavicle.
3. Position the left leg (F) electrode on the left mid-clavicular line, 6th and 7th intercostal space.

PLACEMENT FOR PACED PATIENTS (AHA)

For ECG cable lead sets with **AHA** (USA) lead designations, the optimal electrode placement for patients with pacemakers may be as illustrated in Figure 7 below:

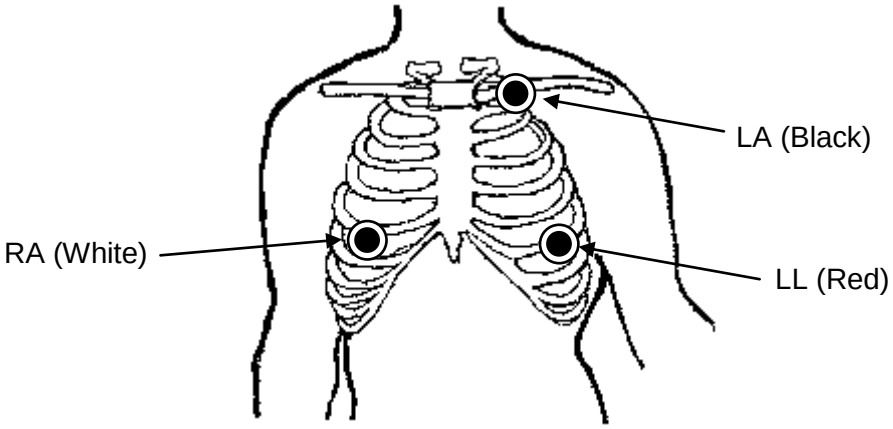

Figure 7: Paced **AHA** Electrode Placement

1. Position the right arm (RA) electrode on the right mid-clavicular line, 5th intercostal space.
2. Position the left arm (LA) electrode on the left mid-clavicular line, directly below the clavicle.
3. Position the left leg (LL) electrode on the left mid-clavicular line, 6th and 5th intercostal space.

PLACEMENT FOR PACED PATIENTS (IEC)

For ECG cable lead sets with **IEC** (Europe) lead designations, the optimal electrode placement for patients with pacemakers may be as illustrated in Figure 8 below:

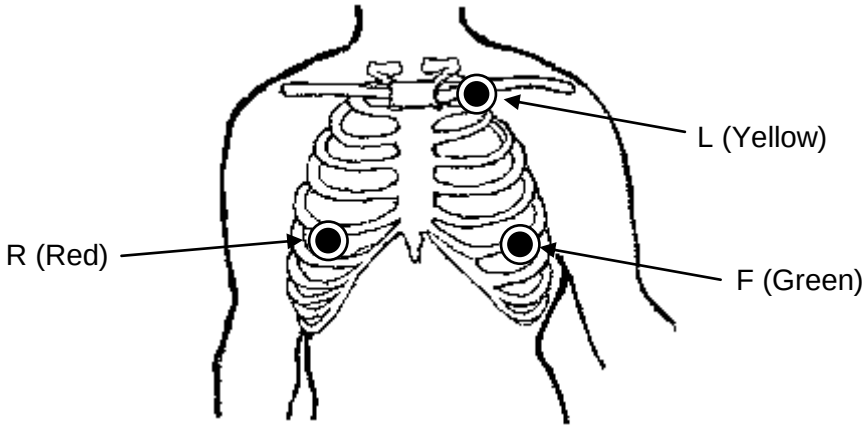

Figure 8: Paced **IEC** Electrode Placement

1. Position the right arm (R) electrode on the right mid-clavicular line, directly below the clavicle.
2. Position the left arm (L) electrode on the left mid-clavicular line, directly below the clavicle.
3. Position the left leg (F) electrode on the left mid-clavicular line, 6th and 7th intercostal space.

VERIFYING PROPER PACEMAKER HANDLING

For paced patients, proper electrode placement results in pacer tick marks along the top of each ECG waveform channel. These tick marks occur at the point where the monitor detects a pacer pulse.

The monitor rejects pacer pulses rather than calling them a QRS complex (per IEC 60601-2-27). However, it is important to keep paced patients under close surveillance and not to entirely rely on rate meters for these patients (as indicated in the warning at the start of this manual).

FREEZING WAVEFORMS

In some clinical environments the user may want to freeze the displayed waveforms.

Touching the right side of the waveform area (under the blue line) will cause all displayed waveforms to be frozen (refer to Figure 9 - ECG & SpO2 waveforms frozen).

Only the waveforms are frozen. Numeric values will continue to be updated, and alarm conditions continue to be generated as they occur.

To unfreeze the displayed waveforms perform one of the following:

- Touch the right side of the waveform area again.

  OR

- Touch anywhere on the screen that will open a menu (e.g., most buttons, numerics, left side of waveform area)

Touching **Alarm Silence** or **Home** button **will not unfreeze** displayed waveforms

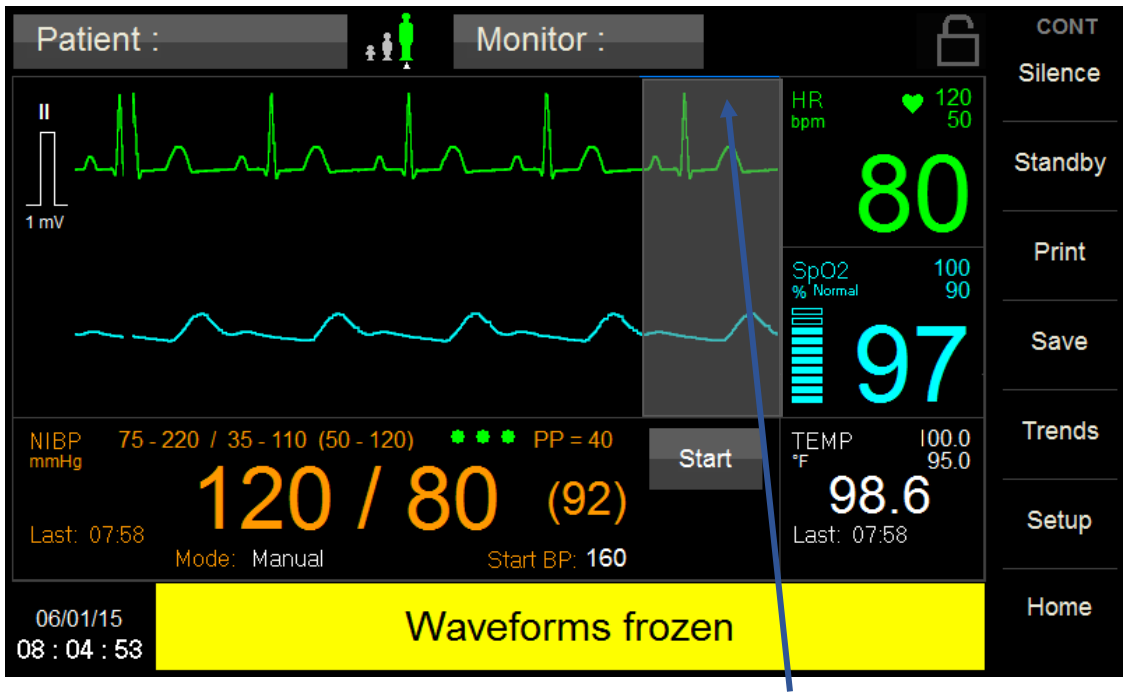

Figure 9: Waveform Frozen - Touch Area is under blue line

ECG SETUP

To begin ECG monitoring use the following procedure:

ECG LEAD WAVEFORM

a. Touch the **left side of the waveform** area

b. Touch the ◄ adjacent to the **Waveform 1** selection (Refer to Figure 10);

b. Touch **I** (**II** or **III)** and touch **OK**; and

c. Touch **Home** to return to the Main screen.

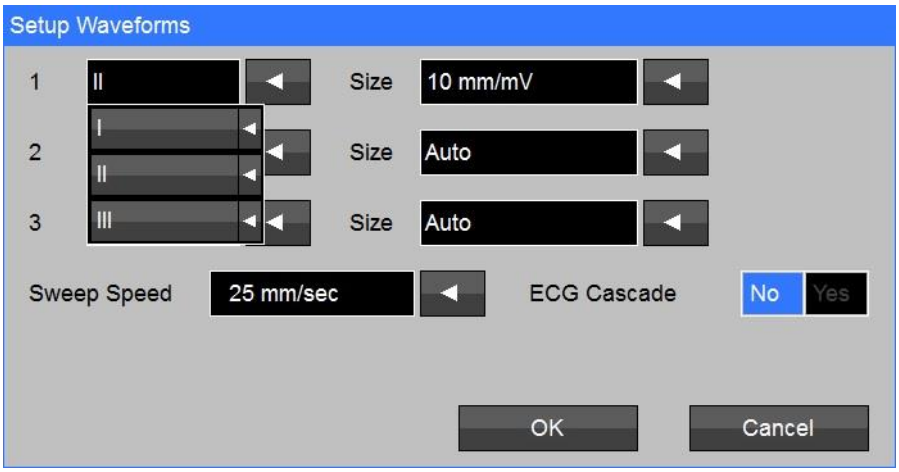

Figure 10: ECG Waveform Setup screen

ECG SIZE

a. Touch the **left side of the waveform** area

b. Touch the ◄ adjacent to the **Waveform 1 Size** selection;

c. Touch (**2.5, 5, 10, 15 or 20 mm/mV**) and **Touch** OK; and

d. Touch **Home** to return to the Main screen.

SWEEP SPEED

e. Touch the **left side of the waveform** area

f. Touch the ◄ adjacent to the **Sweep Speed** selection;

g. Touch (**6.26, 12.5 or 25 mm/sec**) and **Touch** OK; and

h. Touch **Home** to return to the Main screen.

ECG CASCADE

i. Touch the **left side of the waveform** area

j. Touch the **Yes** adjacent to the **ECG Cascade** selection to Enable;
OR

k. Touch the **No** adjacent to the **ECG Cascade** selection to Disable;

l. Touch **Home** to return to the Main screen.

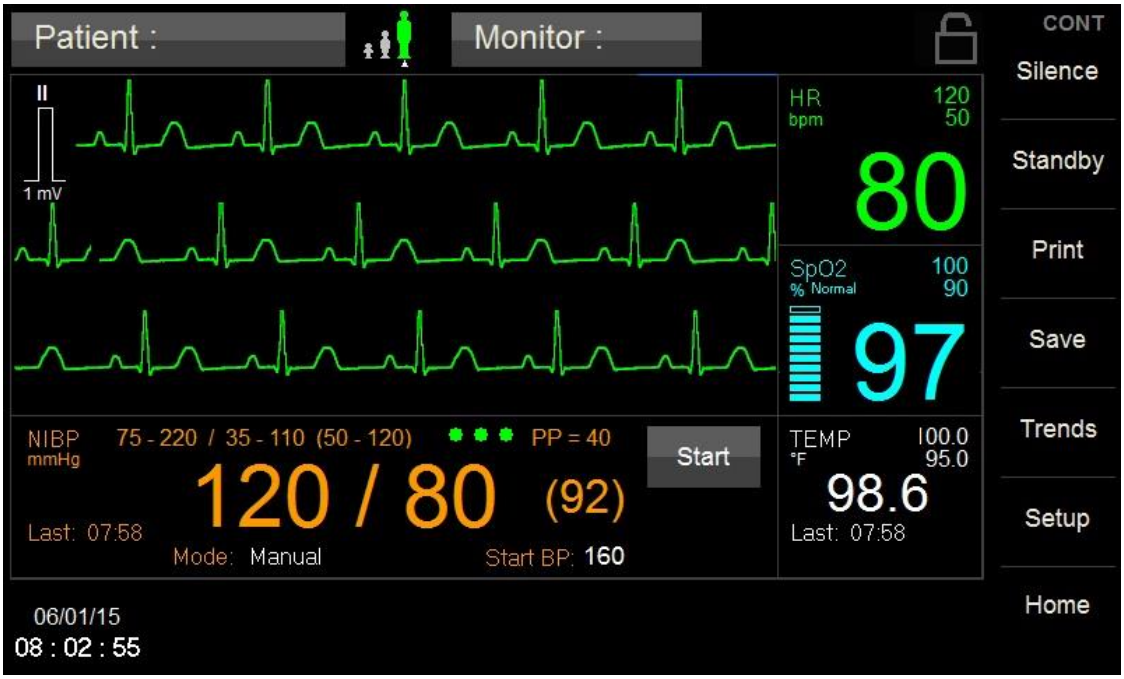

Figure 11: ECG Cascade Enabled

HR PARAMETER SETUP

Table 11 on page 38 lists the Default HR Alarm Limits for Adult, Pediatric, and Neonatal.

Table **12** on page 39 lists the Default ECG & HR Parameter Setting for Adult, Pediatric, and Neonatal. HR Alarm Limits and Parameter settings will operate for the current monitor patient mode.

HR ALARM LIMITS:

1) Touch HR Numeric field and the Setup HR menu will be displayed (refer to Figure 12);

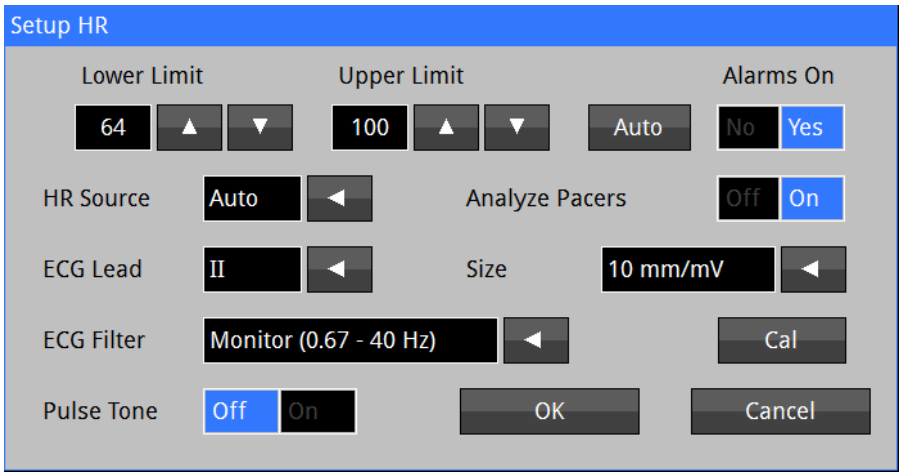

Figure 12: HR Setup Menu

2) Set Alarms On to Yes to enable HR alarms, or No to disable HR alarms.

Warning: If Alarms On is set to "No" the monitor will not generate any visual or audible indication of an alarm condition for HR.

3) Adjust the desired HR Upper or Lower Limit value.
   - The HR Upper and Lower Alarm Limits can be adjusted independently.
4) Touch OK to accept or Cancel to ignore the selection.
5) Touch the Home touch area to return to the Main screen.

HR AUTO (set) ALARM LIMITS

The Upper and Lower alarm limits for HR can be set automatically using the Auto feature, which provides a structure to establish alarms limits based upon your patient's current measured value.

To enable Auto limits, open the HR Setup Window and touch the "**AUTO**" key on the same line with the parameter (refer to Table 1 for HR percentages).

Parameter	**Alarm Limit Adjustment (x% of the current measured value**	
	Lower	**Upper**
HR	80%	125%

Table 1: HR Auto Alarm Limit Adjustment

Note: When Auto Limits adjust the Lower Limit, the adjustment shall not be allowed to be set to anything less than the Lower Limit, and when Auto Limits adjust the Upper Limit, the adjustment shall not be allowed to be set to anything greater than the Upper Limit.

HR SOURCE

The user-selectable **HR Source** feature allows the clinician to select the desired source of the Heart Rate numeric and associated alarm limit annunciation.

User Selectable settings: Auto (Default), ECG, NIBP & SpO_2

When the HR Source setting is set to Auto, the monitor computes the HR value based on the following sequential rules:

1. If a valid HR is available from ECG, this value is displayed as HR and the numeric field is labeled HR;
2. If ECG detects “Asystole” or “HR Ventricular Fibrillation”, the associated text value (“ASY” or “VF” respectively) is displayed as HR value and numeric field is labeled HR;

Note: If during Alarm Pause condition, a High Priority alarm occurs (Asystole or HR Ventricular Fibrillation), the Alarm Pause condition will be exited and the High Priority Alarm shall be annunciated immediately.

3. If ECG detects “Leads Off”, the numeric field is labeled HR;

   Acknowledged no ECG present

4. If a valid PR is available from SpO_2, this value is displayed as PR and the numeric field is labeled as PR;
5. If SpO_2 detects a “SpO_2 Check Sensor Placement”, “SpO_2 weak signal”, “SpO_2 artifact”, “SpO_2 problem detected”, “SpO_2 unplugged” or “SpO_2 replace sensor” condition, numeric is blank and the numeric field is labeled PR;

   Acknowledged no SpO_2 present

6. If a valid PR is available from NIBP, this value is displayed as PR and the numeric field is labeled as PR;
7. If NIBP detects “NIBP weak signal”, “NIBP artifact”, “NIBP cuff leak”, “NIBP blocked hose -- check patient”, “NIBP measurement time exceeded”, “NIBP problem detected”, or “NIBP cannot measure” condition, the numeric is blank and the numeric field is labeled HR;

   Acknowledged no NIBP reading available

8. Blank value is displayed as HR and the numeric field is labeled as HR;

ANALYZE PACERS

Touch the **On** adjacent to the **Analyze Pacers** selection to Enable.

OR

Touch the **Off** adjacent to the **Analyze Pacers** selection to Disable.

When Analyze Pacers is set to On, the monitor will display white pace detect marks at the top of the ECG waveform to indicate where pacer pulses were detected.

When Analyze Pacers is set to Off, the the monitor will display a message advising you that the pacer detect function has been disabled.

Warning: PACEMAKER PATIENTS. When Analyze Pacers is disabled, the Heart Rate may continue to count the pacemaker rate during occurrences of cardiac arrest. Keep pacemaker patients under close surveillance and do not rely entirely upon Heart Rate alarms.

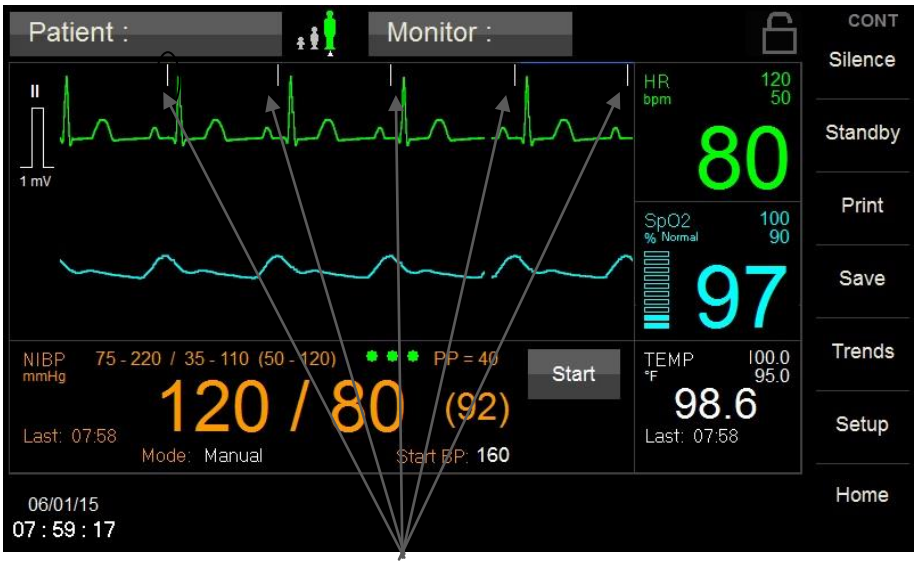

Figure 13: Analyze Pacers Enabled

PULSE TONE

The user-selectable **Pulse Tone** feature allows the clinician to select the desired to sound a tone for each pulse detected.

User Selectable settings: Off (Default) & On

ECG LEAD

The user-selectable **ECG Lead** feature allows the clinician to select the desired ECG Lead waveform on the display.

User Selectable settings: I, II (Default) & III

SIZE

The user-selectable **Size** feature allows the clinician to select the desired size of the ECG waveform on the display.

User Selectable settings: 2.5, 5, 10 (Default), 15 & 20 mm/mV

ECG FILTER

The user-selectable **ECG Filter** feature allows the clinician to select the desired filtering of the displayed ECG waveform.

User Selectable settings: Monitor (0.67 - 40 Hz) (Default) & Diagnostic (0.05 - 40 Hz)

CAL PULSE

The user-selectable **Cal Pulse** feature allows the clinician to insert a 1 mV pulse onto the currently selected ECG waveform. Press the **Cal Pulse** button and then **OK**. Upon returning to the Main screen, the pulse will be injected onto the ECG waveform (refer to Figure 14).

Note: Pressing the **Cal Pulse** button more than once will only produce one pulse. Pressing the **Cal Pulse** button and then the **Cancel** button will not generate a pulse. Returning to the Main screen due to the menu inactivity timeout, will not generate a pulse.

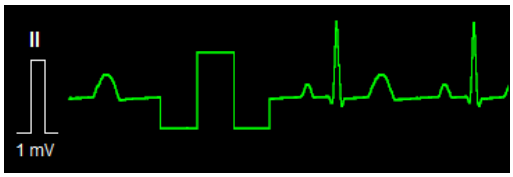

Figure 14: ECG Cal Pulse

TESTING HR ALARMS

To manually test ECG monitoring alarm functionality on a daily basis, you may use the following approach:

1. Connect the monitor to an ECG Patient simulator via the 3 leads;
2. Set the ECG Patient simulator for 1 mV ECG amplitude, HR of 80 bpm, RR of 12 rpm and an impedance baseline of 500Ω;
3. Enable the HR alarms;
4. Lower the HR upper alarm limit setting below its current value;
5. Verify that "HR < [upper limit]" annunciates as a medium level alarm;
6. Press the ALARM SILENCE key;
7. Return the HR upper alarm limit to its previous value; and
8. Verify that the alarm is no longer active, and that ECG monitoring continues normally.

   Repeat this steps 3-7 for the HR lower limit Test.
9. Alternatively, disconnect the RA or LL electrode;
10. Verify that "HR lead off" annunciates as a low level alarm;
11. Press ALARM SILENCE and reconnect the electrode; and
12. Verify that the alarm is no longer active and that ECG monitoring continues normally.

The ECG Monitoring settings and specifications may be found Section 9, SPECIFICATIONS.

ECG AND HEART RATE MONITORING MESSAGES

Table 2 indicates the Monitor Messages associated with the HR parameter:

Message	Parameter Value	Possible Cause	Suggested Action
HR < [lower limit]	[number]	The patient's heart rate has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
HR > [upper limit]	[number]	The patient's heart rate has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
HR asystole	ASY	No QRS detected for last 4 seconds	Check the patient and provide any necessary clinical care. Check the ECG lead being used to calculate the heart rate (the top displayed lead) – make sure that the QRS amplitude on this lead is at least 0.5 mV. Change to another ECG lead to get adequate QRS amplitude. Reposition or change electrodes if no lead gives adequate QRS amplitudes. Remember the importance of good skin preparation techniques.
HR ventricular fibrillation	VF	No organized ventricular rhythm detected	Check the patient and provide any necessary clinical care. Check the ECG lead being used to calculate the heart rate (the top displayed lead) – make sure that the QRS amplitude on this lead is at least 0.5 mV. Change to another ECG lead to get adequate QRS amplitude. Reposition or change electrodes if no lead gives adequate QRS amplitudes. Remember the importance of good skin preparation techniques.
HR lead off	[blank]	Unplugged cable Broken cable Loose lead wire Faulty lead wire Dried out electrode Inoperable ECG circuit Intentional removal by clinician	Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques. Check to make sure all the lead wires are still connected to the electrodes. Check to make sure the lead wires are securely connected to the monitor. Check to make sure there are no broken lead wires. Turn monitor off, then back on If message persists, contact Zoe technical support. Press ALARM SILENCE in the event of intentional removal by clinician.
HR artifact	---	Patient movement Electrical noise from auxiliary equipment Bad electrode contact	Calm the patient. Isolate the patient from auxiliary equipment, if possible. Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques.

Table 2: HR Monitoring Messages

4. RESPIRATION MONITORING

Note: The following Warnings and Cautions are directed toward the Respiration monitoring function. Additional Warnings and Cautions for the **740 SELECT** monitor are found in the **740 SELECT** User Manual, Zoe Medical PN 21-22-0316.

WARNINGS

Warning: Operating the monitor with RR limit alarms disabled means that no low or high RR alarm conditions will produce alarm notifications. Use this feature with extreme caution. Patients must be closely observed if RR limit alarms are disabled.

Warning: When using an ECG electrode to calculate respiration rate via the thorax impedance method, movement artifacts may create inaccurate results. Respiration rates derived from CO_2 parameter is not subject to such movement artifacts.

NOTES

Note: If the Monitor is configured with a capnography module ($ETCO_2$), the Monitor will not allow the display of the Respiration Waveform or Numeric from the ECG source.

Refer to User Manual Addendum - $ETCO_2$ Parameters, Zoe Medical PN 21-22-0333 for additional information regarding Respiration from $ETCO_2$.

Note: If the monitor is not configured for $ETCO_2$, and Respiration waveform or Numeric is not currently displayed, follow the instructions to enable the display the Respiration parameter in the ENABLING DISPLAY OF RESPIRATION Section on page 27.

Note: If the monitor is not configured for $ETCO_2$, and the Respiration waveform is not currently displayed, follow the instructions to display the Respiration waveform in the RESPIRATION WAVEFORM section, page 28.

Note: Configuring the monitor for Neonatal patient mode will disable the Respiration parameter (Waveform and Numeric). Switching back to Adult or Pediatric patient modes will require re-enabling the Respiration parameter.

ENABLING DISPLAY OF RESPIRATION

To enable the display of Respiration (Waveform and Numeric) use the following procedure:

a. Touch the **Setup** button on the right side of the Main Screen

b. Touch the **Home Screen** button and the Setup Home Screen will be displayed. Refer to Figure 15.

c. Touch the **Yes** adjacent to the **RESP Enabled** selection to Enable displaying of Resp Waveform & Numeric;

OR

d. Touch the **No** adjacent to the **RESP Enabled** selection to Disable displaying of Resp Waveform & Numeric;

e. Touch **Home** to return to the Main screen.

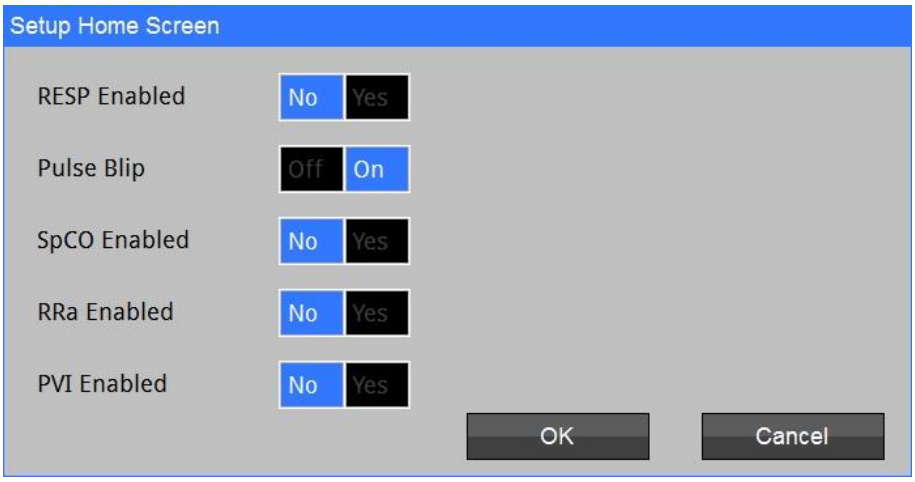

Figure 15: Setup Home Screen

Note: If the Monitor is configured with a capnography module ($ETCO_2$), the Monitor will not allow the display of the Respiration Waveform or Numeric from the ECG source.

GETTING STARTED WITH RESPIRATION

To begin monitoring Respiration, follow the patient preparation and electrode placement procedures that are described in the ELECTRODE PLACEMENT section of this manual, starting on page 16.

CHECKING THE RESPIRATION SIGNAL

When you have connected the patient to the monitor, you should be able to see a clean, slowly oscillating Respiration signal on the Monitor display. This may take up to 30 seconds after the patient has been connected. The Monitor should also display the patient's respiration rate (RR) and alarm limit settings.

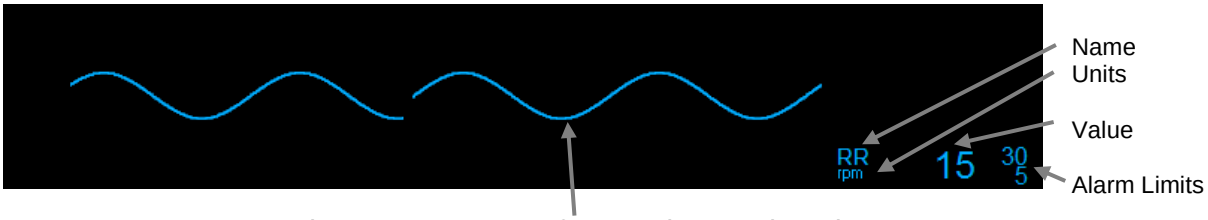

Figure 16: RR Waveform and Numeric Value

The Respiration Rate Monitoring settings and specifications may be found in the SPECIFICATIONS chapter of this manual.

Procedures for changing configuration settings, such as enabling alarms, or adjusting alarm limits, may be found in the RESPIRATION SETUP chapter.

FREEZING WAVEFORMS

In some clinical environments the user may want to freeze the displayed waveforms.

Touching the right side of the waveform area (under the blue line) will cause all displayed waveforms to be frozen. Refer to Figure 9 in FREEZING WAVEFORMS section on page 18 for additional information regarding freezing waveforms.

RESPIRATION SETUP

To begin Respiration monitoring use the following procedure:

RESPIRATION WAVEFORM

f. Touch the **left side of the waveform** area

g. Touch the ◄ adjacent to the **Waveform 2** selection (Refer to Figure 17);

d. Touch **Resp** and touch **OK**; and

e. Touch **Home** to return to the Main screen.

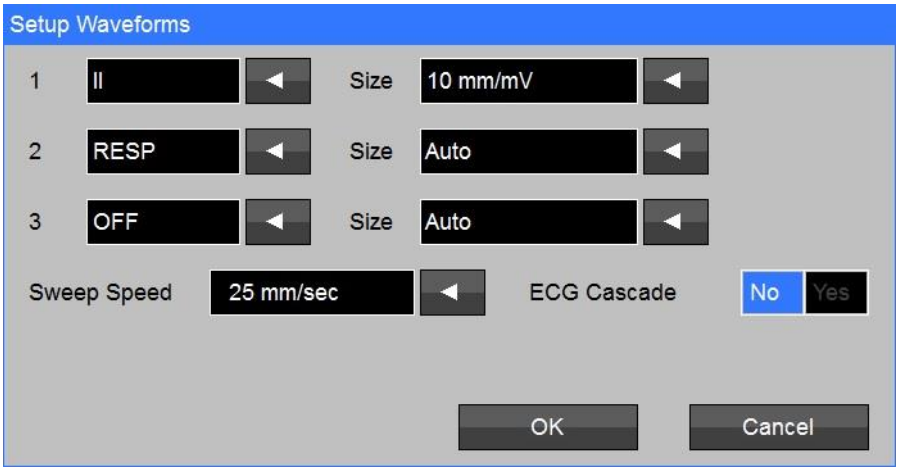

Figure 17: Resp Waveform Setup screen

Note: If the Monitor is configured with a capnography module ($ETCO_2$), the Monitor will not allow the display of the Respiration Waveform or Numeric from the ECG source.

RR PARAMETER SETUP

Table 11 on page 38 lists the Default RR Alarm Limits for Adult and Pediatric.

Table **12** on page 39 lists the Default RR Parameter Setting for Adult and Pediatric. RR Alarm Limits and Parameter settings will operate for the current monitor patient mode.

RR ALARM LIMITS:

1) Touch RR Numeric field and the Setup RR menu will be displayed (refer to Figure 18);

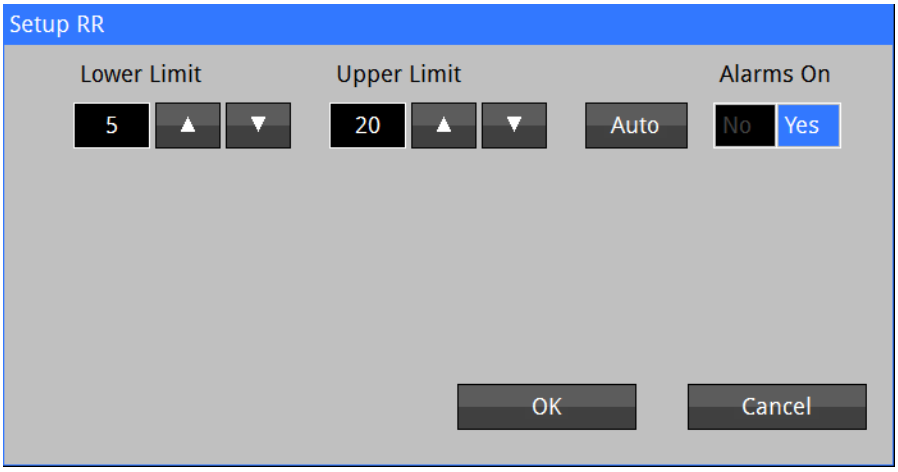

Figure 18: RR Setup Menu

2) Set Alarms On to Yes to enable RR alarms, or No to disable RR alarms.

Warning: If Alarms On is set to "No" the monitor will not generate any visual or audible indication of an alarm condition for RR.

3) Adjust the desired RR Upper or Lower Limit value.
   - The RR Upper and Lower Alarm Limits can be adjusted independently.
4) Touch OK to accept or Cancel to ignore the selection.
5) Touch the Home touch area to return to the Main screen.

RR AUTO (set) ALARM LIMITS

The Upper and Lower alarm limits for RR can be set automatically using the Auto feature, which provides a structure to establish alarms limits based upon your patient's current measured value.

To enable Auto limits, open the RR Setup Window and touch the "**AUTO**" key on the same line with the parameter (refer to Table 3 for RR percentages).

Parameter	**Alarm Limit Adjustment (x% of the current measured value**	
	Lower	**Upper**
RR	80%	125%

Table 3: RR Auto Alarm Limit Adjustment

Note: When Auto Limits adjust the Lower Limit, the adjustment shall not be allowed to be set to anything less than the Lower Limit, and when Auto Limits adjust the Upper Limit, the adjustment shall not be allowed to be set to anything greater than the Upper Limit.

TESTING RR ALARMS

To manually test Respiration monitoring alarm functionality on a daily basis, you may use the following approach:

Note: Testing of RR Alarms may only be done when the monitor is set Adult or Pediatric patient modes.

1. Connect the monitor to an ECG Patient simulator via the 3 leads;
2. Set the ECG Patient simulator for 1 mV ECG amplitude, HR of 80 bpm, RR of 12 rpm and an impedance baseline of 500Ω;
3. Enable the RR alarms;
4. Lower the RR upper alarm limit setting below its current value;
5. Verify that "RR < [upper limit]" annunciates as a medium level alarm;
6. Press the ALARM SILENCE key;
7. Return the RR upper alarm limit to its previous value; and
8. Verify that the alarm is no longer active, and that Resp monitoring continues normally.

   Repeat this steps 3-7 for the RR lower limit Test

9. Alternatively, disconnect the RA or LL electrode;
10. Verify that "HR lead off" annunciates as a low level alarm;
11. Press ALARM SILENCE and reconnect the electrode; and
12. Verify that the alarm is no longer active and that ECG monitoring continues normally.

The Resp Monitoring settings and specifications may be found Section 9, SPECIFICATIONS.

RESPIRATION RATE MONITORING MESSAGES

Table 2 indicates the Monitor Messages associated with the RR parameter:

Message	Parameter Value	Possible Cause	Suggested Action
RR < [lower limit]	[number]	The patient's respiration rate has fallen below the current lower alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
RR > [upper limit]	[number]	The patient's respiration rate has risen above the current upper alarm limit.	Check the patient and provide any necessary clinical care. Change the alarm limit if it is no longer clinically appropriate.
RR out of range (too high)	---	The patient's respiration rate has risen above the maximum value the monitor can accurately detect. Electrical noise from auxiliary equipment Monitor confused by signal artifact	Check the patient and provide any necessary clinical care. Isolate the patient from auxiliary equipment, if possible. Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques.
RR lead off	[blank]	Unplugged cable Broken cable Loose lead wire Faulty lead wire Dried out electrode Inoperable respiration detection circuit Intentional removal by clinician	Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques. Check to make sure all the lead wires are still connected to the electrodes. Check to make sure the lead wires are securely connected to the monitor. Check to make sure there are no broken lead wires. Press ALARM SILENCE in the event of intentional removal by clinician. Turn monitor off, then back on If message persists, contact Zoe technical support.
RR artifact	---	Patient movement Electrical noise from auxiliary equipment Bad electrode contact	Calm the patient. Isolate the patient from auxiliary equipment, if possible. Check to make sure electrodes are still securely attached to the patient, and reattach if necessary. Remember the importance of good skin preparation techniques.

Table 4: Resp Monitoring Message

5. ACCESSORIES

Contact our Customer Service Department or go to our website for the latest product information. Refer to page 3 for email, website and phone number information.

ECG - AAMI

Table 6 indicates the AAMI ECG parts and accessories to be used with **740 SELECT** Monitor.

Catalog No.	Description	Illustration
01-02-0920	**740 SELECT** AAMI 3-Lead ECG Patient Cable, 2M	
01-02-0923	**740 SELECT** AAMI 3-Lead Snap Set, 1M	
01-02-0921	**740 SELECT** AAMI 3-Lead Mini-Clip Set, 1M	
01-02-0891	740 SELECT AAMI 3-Lead ECG Adult/Peds Kit	
	• 01-02-0920 **740 SELECT** AAMI 3-Lead ECG Patient Cable, 2M	
	• 01-02-0923 **740 SELECT** AAMI 3-Lead Snap Set, 1M	
	• 21-03-0379 **740 SELECT** ECG Quick Reference Guide Addendum	
01-02-0892	740 SELECT AAMI 3-Lead ECG Neo Kit	
	• 01-02-0920 **740 SELECT** AAMI 3-Lead ECG Patient Cable, 2M	
	• 01-02-0921 **740 SELECT** AAMI 3-Lead Mini-Clip Set, 1M	
	• 21-03-0379 **740 SELECT** ECG Quick Reference Guide Addendum	

Table 5: AAMI ECG parts and accessories

ECG - IEC

Table 6 indicates the IEC ECG parts and accessories to be used with 740 SELECT Monitor.

Catalog No.	Description	Illustration
01-02-0929	740 SELECT IEC 3-Lead ECG Patient Cable, 2M	
01-02-0927	740 SELECT IEC 3-Lead Snap Set, 1M	
01-02-0925	740 SELECT IEC 3-Lead Mini-Clip Set, 1M	
01-02-0893	740 SELECT IEC 3-Lead ECG Adult/Peds Kit	
	• 01-02-0929 740 SELECT IEC 3-Lead ECG Patient Cable, 2M	
	• 01-02-0927 740 SELECT IEC 3-Lead Snap Set, 1M	
	• 21-03-0379 740 SELECT ECG Quick Reference Guide Addendum	
01-02-0894	740 SELECT IEC 3-Lead ECG Neo Kit	
	• 01-02-0929 740 SELECT IEC 3-Lead ECG Patient Cable, 2M	
	• 01-02-0925 740 SELECT IEC 3-Lead Mini-Clip Set, 1M	
	• 21-03-0379 740 SELECT ECG Quick Reference Guide Addendum	

Table 6: IEC ECG parts and accessories

6. DISPOSAL

ACCESSORIES

The disposal of accessories such as ECG accessories should be carried out according to the manufacturer's recommendations.

MONITOR

At the end of its useful life, the monitor should be properly disposed of as well. In particular, the monitor contains a lithium coin battery, a lithium ion battery, and electronic circuit boards which should not be incinerated or exposed to extreme heat. Refer to Warnings and Cautions at the start of the **740** SELECT User Manual, Zoe Medical PN 21-22-0316 for further precautions.

GUIDANCE

Contact your local waste disposal agency for guidance on the proper recycling or disposal of these components.

7. MAINTENANCE

The following table shows the recommended maintenance procedures for the **740** SELECT monitor and its accessories. The monitor does not require periodic recalibration. However, it is a good idea to check that the monitor is in good working order, as described in the following table. These functional tests should be done every 12 months, and they can be performed by clinicians or qualified service personnel.

EQUIPMENT

The following equipment is needed to perform these procedures:

- ECG/Respiration Simulator (e.g., Fluke® [1] Biomedical MPS-450)

FUNCTIONAL TESTS

Follow the steps outlined in Table 7 to perform the functional test for the ECG - HR & RR Parameters.

Function	*Procedure*
ECG - HR	Connect ECG leads to Patient Simulator. • Verify proper heart rate (HR) at 30 and 300 bpm (+/- 2 bpm or +/- 1%) • Verify 1 mV test pulse (Lead II)
- RR	• Verify proper respiration rate (RR) at 15 and 120 rpm (+/- 3 rpm)

Table 7: ECG - HR & RR Parameter Functional Test Steps

1 Fluke is a Registered Trademark of Fluke Corporation

8. CLEANING

Caution: Always disconnect the monitor from AC mains before cleaning.

Caution: Do not use harsh chemicals for cleaning – in particular, do not use disinfectants that contain phenol as they can spot plastics. Do not steam autoclave, gas sterilize, irradiate, subject to intense vacuum, or immerse in water or cleaning solution. Be careful to avoid getting cleaning liquids into connectors or the unit. If this occurs, allow the unit to dry in warm air for 2 hours, then check to make sure all monitoring functions are still working properly.

Caution: Accessories that fall on the floor should be inspected for contamination and proper functionality. If contamination is observed, then this cleaning procedure should be followed.

Caution: The user has the responsibility to validate any deviations from the recommended method of cleaning and disinfection.

Table 8 provides cleaning instructions for ECG Accessories used with the monitor, which should be cleaned monthly or as warranted. Accessories should be cleaned before application to a patient. Before cleaning, refer to the cautions listed above.

Part	Recommended cleaning method
ECG Cables	**Materials** • Enzymatic detergent such as ENZOL® [1] (US) or CIDEZYME® [2] (outside the US) • Distilled water • Disinfectant solution (such as CIDEX OPA® [2], or a 10% solution of household bleach (5.25% sodium hypochlorite) in distilled water) • Soft cloths and/or soft-bristled brushes • Protective gloves and eyewear
	Procedure 1. Disconnect the unit from the wall outlet. 2. Put on gloves and protective eyewear. 3. Prepare the enzymatic detergent according to the manufacturer's instructions, and also the disinfectant solution, in separate containers. 4. Apply detergent to product using a soft cloth - If material is dried on, allow to sit for 1 minute. 5. Wipe smooth surfaces with the cloth. 6. Use a soft-bristle brush on visibly soiled areas and irregular surfaces. 7. Remove detergent from product using cloth dampened in distilled water. 8. Repeat as necessary. 9. Apply disinfectant solution on affected area using a soft cloth - Allow product to sit for 5 minutes. 10. Wipe away excess solution and clean product again with cloth dampened in distilled water. 11. Allow 2 hours for drying.

Table 8: ECG Accessory Cleaning Instructions

[1] ENZOL is a Registered Trademark of Synclaire Brands, Inc.,

[2] CIDEZYME and CIDEX OPA are a Registered Trademarks of Advanced Sterilization Products (ASP)

9. SPECIFICATIONS

ECG AND HR

Table 9 indicates the Specifications associated with ECG and HR Parameter.

DEVICE MARKINGS

	Type CF Equipment (Defibrillation-proof)
ECG	3 wire ECG connector

GENERAL

Patient Populations	Adult and Pediatric
Accessories	3-lead cable
Input Connector	7-pin connector
Displayable Leads	3-lead cable: I, II, III
HR Resolution	1 bpm (beats per minute)
Measurement Range	15 to 300 bpm
Measurement Accuracy	±2 bpm or ±1%, whichever is greater
Response Time	Per IEC 60601-2-27, change from 80 to 120 bpm: < 7 seconds Per IEC 60601-2-27, change from 80 to 40 bpm: < 11 seconds
Report Interval	1 second
HR Averaging Scheme	Average of the 10 most recent, valid R-R intervals, discarding the shortest and longest interval
Time To Alarm - Tachycardia	IEC 60601-2-27, ECG Complex B1: < 10 sec (5 sec typical) IEC 60601-2-27, ECG Complex B2: < 10 sec (9 sec typical)
Notch Filter Frequency	50Hz, 60 Hz, Off
Filter Bandwidth	Monitor Mode: 0.67 Hz to 40 Hz (-3 dB) Diagnostic Mode: 0.05 to 40 Hz (-3 dB)
Dynamic Range AC	±5 mV, per IEC 60601-2-27
Dynamic Range DC	±300 mV, per IEC 60601-2-27
Electrode Impedance	>2.5 MOhm, per IEC 60601-2-27
Defibrillation Protection	Complies with IEC 60601-2-27
Pacer Pulse Detection	Lead I, II or III
Pacer Pulse Rejection	Rejects all pulses of amplitude ±2mV to ±700mV and duration 0.1 to 2 ms, per IEC 60601-2-27, Clause 201.12.1.101.13
Tall T-Wave Rejection	Rejects T-Waves less than or equal to 120% of a 1mV QRS and a Q-T interval of 350 ms, per IEC 60601-2-27, Clause 201.12.1.101.17
HR Response to Irregular Rhythm	IEC 60601-2-27, ECG Complex A1: HR is 80 bpm IEC 60601-2-27, ECG Complex A2: HR is 65 bpm IEC 60601-2-27, ECG Complex A3: HR is 120 bpm IEC 60601-2-27, ECG Complex A4: HR is 91 bpm
Active Noise Suppression	RL drive (< 5 µA)
Pulse Tone	Yes
Standards Conformance	IEC 60601-2-27, ECG Monitoring

Table 9: ECG & HR Specifications

RESPIRATION AND RR

Table 10 indicates the Specifications associated with Respiration and RR Parameter.

Patient Populations	Adult, adolescent, child and infants
Method	Impedance Pneumography
Input Connector	Same as ECG
Sensing Lead	II
RR Resolution	1 rpm (breaths per minute)
Measurement Range	0 to 120 rpm
Measurement Accuracy	±3 rpm
Measurement Sensitivity	0.25 ohms (minimum)
Report Interval	1 second
Bandwidth	0.17 to 3.3 Hz (-3dB)
Impedance Measuring Current	40 µA @ 28 kHz square wave across Lead II

Table 10: Respiration & RR Specifications

PARAMETER ALARM LIMITS & SETTINGS

Parameter	Units	Adult			Pediatric			Neonatal		
		Alarms On Default	Limit Default	Limit Range	Alarms On Default	Limit Default	Limit Range	Alarms On Default	Limit Default	Limit Range
HR upper	bpm	Yes	120	16 – 300	Yes	120	16 – 300	Yes	180	16 – 300
HR lower	bpm	Yes	50	15 - 299	Yes	50	15 - 299	Yes	100	15 - 299
RR upper	rpm	Yes	20	6 - 150	Yes	45	6 - 150	NA	NA	NA
RR lower	rpm	Yes	5	5 - 149	Yes	10	5 - 149	NA	NA	NA

Note: Lower Alarm Limit cannot be set above the associated Upper Alarm Limit.

Note: Upper Alarm Limit cannot be set lower than the associated Lower Alarm Limit.

Table 11: HR & RR Parameter Alarm Limit Ranges

Table **12** lists the ECG, HR & RR Parameter settings and Ranges.

Parameter	Defaults			Range
	Adult	**Pediatric**	**Neonatal**	
ECG Lead	II	II	II	I, II, III
(ECG Lead) Size	10 mm/mV	10 mm/mV	10 mm/mV	2.5, 5, 10, 15 mm/mV
HR Source	Auto	Auto	Auto	Auto, ECG, SpO_2, NIBP
Pulse Tone Source	Off	Off	Off	ECG, SpO_2, Off
ECG Filter	Monitor (0.67 – 40 Hz)	Monitor (0.67 – 40 Hz)	Monitor (0.67 – 40 Hz)	Monitor (0.67 – 40 Hz), Diagnostic (0.05 – 40 Hz)
Channel 1-3 Waveform	II	II	II	I, II, III
ECG Waveform Size	10 mm/mV	10 mm/mV	10 mm/mV	2.5, 5, 10, 15 mm/mv
Sweep Speed	25 mm/sec	25 mm/sec	25 mm/sec	6.25, 12.5, 25 mm/sec
Show Beat Detect Spikes	Yes	Yes	Yes	No, Yes
Notch Filter	60 Hz	60 Hz	60 Hz	60 Hz, 50 Hz, Off

Table 12: ECG, HR & RR Parameter Setting Ranges

NOTES: