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- the electrical installation of the relevant room complies with the applicable national and local requirements;
- the product is used in accordance with the instructions for use.

WARNING

- Only skilled/trained clinical professionals should operate this equipment.
- It is important for the hospital or organization that uses this equipment to perform a recommended service/maintenance plan. Neglect of this may result in machine breakdown or personal injury.
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Mindray maintains a network of service representatives and factory-trained distributors. Prior to requesting service, perform a complete operational check of the instrument to verify proper control settings. If operational problems continue to exist.

In North America contact the Service Department at (800) 288-2121, ext: 8116 for Technical Support or (201) 995-8000 for assistance in determining the nearest field service location.

Please include the instrument model number, the serial number, and a description of the problem with all requests for service.

Any questions regarding the warranty should be directed to the local sales or service representative.

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Preface

Manual Purpose

This manual contains the instructions necessary to operate the product safely and in accordance with its function and intended use. Observance of this manual is a prerequisite for proper product performance and correct operation and ensures patient and operator safety.

This manual is based on the maximum configuration and therefore some contents may not apply to the product. If you have any question, please contact us.

This manual is an integral part of the product. It should always be kept close to the equipment so that it can be obtained conveniently when needed.

Intended Audience

This manual is geared for clinical professionals who are expected to have a working knowledge of medical procedures, practices and terminology as required for monitoring of patients.

Illustrations

All illustrations in this manual serve as examples only. They may not necessarily reflect the setup or data displayed on the patient monitor.

Conventions

- **Italic text** is used in this manual to quote the referenced manuals, chapters, sections and formulas.
- **Bold text** is used to indicate the screen texts and names of hard keys.
- **→** is used to indicate operational procedures.
5 Managing Patients ................................................................. 5 - 1

5.1 Starting Monitoring a Patient ........................................... 5 - 1

5.2 Admitting a Patient ........................................................ 5 - 1

5.2.1 Entering the Patient Management Dialog ................ 5 - 1

5.2.2 Editing Patient Information ........................................ 5 - 1

5.2.3 Loading Patient Information from the CMS ............ 5 - 2

5.2.4 Loading Patient Information from the ADT Server ...... 5 - 2

5.3 Transferring Patient ....................................................... 5 - 2

5.4 Exporting Patient Data .................................................. 5 - 3

5.5 Deleting Patient Data ..................................................... 5 - 3

5.6 Stopping a Parameter Measurement .............................. 5 - 3

5.7 Discharging a Patient .................................................... 5 - 3

6 Alarms .................................................................................. 6 - 1

6.1 Alarm Introduction ......................................................... 6 - 1

6.2 Alarm Safety Information .............................................. 6 - 1

6.3 Understanding the Alarms ............................................. 6 - 1

6.3.1 Alarm Categories ................................................... 6 - 1
## 7 Monitoring ECG, Arrhythmia, ST and QT

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 ECG Introduction</td>
<td>7 - 1</td>
</tr>
<tr>
<td>7.2 ECG Safety Information</td>
<td>7 - 1</td>
</tr>
<tr>
<td>7.3 ECG Display</td>
<td>7 - 2</td>
</tr>
<tr>
<td>7.4 Preparing for ECG Monitoring</td>
<td>7 - 2</td>
</tr>
<tr>
<td>7.4.1 Preparing the Patient Skin</td>
<td>7 - 2</td>
</tr>
<tr>
<td>7.4.2 Applying Electrodes and Connecting the Patient</td>
<td>7 - 2</td>
</tr>
<tr>
<td>7.4.3 Lead Wire Color Code</td>
<td>7 - 3</td>
</tr>
<tr>
<td>7.4.4 ECG Electrode Placements</td>
<td>7 - 3</td>
</tr>
<tr>
<td>7.4.5 Choosing the ECG Lead Type</td>
<td>7 - 5</td>
</tr>
<tr>
<td>7.4.6 Checking Paced Status</td>
<td>7 - 5</td>
</tr>
<tr>
<td>7.4.7 Enabling Pacer Rejection</td>
<td>7 - 6</td>
</tr>
<tr>
<td>7.5 Changing ECG Settings</td>
<td>7 - 6</td>
</tr>
<tr>
<td>7.5.1 Choosing an ECG Screen</td>
<td>7 - 6</td>
</tr>
<tr>
<td>7.5.2 Setting ECG Alarm Properties</td>
<td>7 - 7</td>
</tr>
<tr>
<td>7.5.3 Changing ECG Wave Settings</td>
<td>7 - 7</td>
</tr>
<tr>
<td>7.5.4 Disabling the Smart Lead Off Function</td>
<td>7 - 8</td>
</tr>
<tr>
<td>7.5.5 Adjusting the QRS Volume</td>
<td>7 - 8</td>
</tr>
<tr>
<td>7.5.6 Adjusting the Minimum QRS Detection Threshold</td>
<td>7 - 9</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>12.2 NIBP Safety Information</td>
<td>12-1</td>
</tr>
<tr>
<td>12.3 NIBP Measurement Limitations</td>
<td>12-2</td>
</tr>
<tr>
<td>12.4 Measurement Modes</td>
<td>12-2</td>
</tr>
<tr>
<td>12.5 NIBP Display</td>
<td>12-2</td>
</tr>
<tr>
<td>12.6 Preparing for NIBP Measurements</td>
<td>12-3</td>
</tr>
<tr>
<td>12.6.1 Preparing the Patient for NIBP Measurements</td>
<td>12-3</td>
</tr>
<tr>
<td>12.6.2 Placing the NIBP Cuff</td>
<td>12-3</td>
</tr>
<tr>
<td>12.7 Starting and Stopping NIBP Measurements</td>
<td>12-4</td>
</tr>
<tr>
<td>12.8 Changing NIBP Settings</td>
<td>12-4</td>
</tr>
<tr>
<td>12.8.1 Setting the NIBP Alarm Properties</td>
<td>12-4</td>
</tr>
<tr>
<td>12.8.2 Setting the Initial Cuff Inflation Pressure</td>
<td>12-5</td>
</tr>
<tr>
<td>12.8.3 Setting the NIBP Interval</td>
<td>12-5</td>
</tr>
<tr>
<td>12.8.4 Selecting NIBP Start Mode</td>
<td>12-5</td>
</tr>
<tr>
<td>12.8.5 Enabling the NIBP End Tone</td>
<td>12-5</td>
</tr>
<tr>
<td>12.8.6 Setting NIBP Sequence</td>
<td>12-5</td>
</tr>
<tr>
<td>12.8.7 Setting the NIBP Display Format</td>
<td>12-6</td>
</tr>
<tr>
<td>12.8.8 Setting the NIBP Alarm Limits Display Switch</td>
<td>12-6</td>
</tr>
<tr>
<td>12.8.9 Showing/Hiding PR</td>
<td>12-6</td>
</tr>
<tr>
<td>12.8.10 Correcting the NIBP Measurements</td>
<td>12-6</td>
</tr>
<tr>
<td>12.9 Assisting Venous Puncture</td>
<td>12-6</td>
</tr>
<tr>
<td>12.10 NIBP Troubleshooting</td>
<td>12-6</td>
</tr>
<tr>
<td>13 Monitoring Invasive Blood Pressure (IBP)</td>
<td>13-1</td>
</tr>
<tr>
<td>13.1 IBP Introduction</td>
<td>13-1</td>
</tr>
<tr>
<td>13.2 Preparing for IBP Monitoring</td>
<td>13-2</td>
</tr>
<tr>
<td>13.2.1 IBP Equipment to Patient Connection</td>
<td>13-2</td>
</tr>
<tr>
<td>13.2.2 Measuring an Invasive Blood Pressure</td>
<td>13-2</td>
</tr>
<tr>
<td>13.2.3 Zeroing the IBP transducer</td>
<td>13-3</td>
</tr>
<tr>
<td>13.3 Measuring ICP Using the Codman ICP Transducer</td>
<td>13-3</td>
</tr>
<tr>
<td>13.3.1 Zeroing the Codman ICP transducer</td>
<td>13-3</td>
</tr>
<tr>
<td>13.3.2 Measuring ICP</td>
<td>13-3</td>
</tr>
<tr>
<td>13.4 IBP Display</td>
<td>13-4</td>
</tr>
<tr>
<td>13.4.1 Overlapping IBP Waveforms</td>
<td>13-4</td>
</tr>
<tr>
<td>13.5 Changing IBP Settings</td>
<td>13-5</td>
</tr>
<tr>
<td>13.5.1 Changing the IBP Alarm Settings</td>
<td>13-5</td>
</tr>
<tr>
<td>13.5.2 Changing the Pressure Label</td>
<td>13-5</td>
</tr>
<tr>
<td>13.5.3 Setting the Pressure Type for Display</td>
<td>13-6</td>
</tr>
<tr>
<td>13.5.4 Changing the Sensitivity</td>
<td>13-6</td>
</tr>
<tr>
<td>13.5.5 Setting the IBP Waveform</td>
<td>13-6</td>
</tr>
<tr>
<td>13.5.6 Setting the Display Format of Artery Pressure</td>
<td>13-7</td>
</tr>
<tr>
<td>13.5.7 Showing/Hiding the Alarm Limits of Artery Pressure</td>
<td>13-7</td>
</tr>
<tr>
<td>13.5.8 Setting the Use PA-D as PAWP Switch (only available when the N1 is used with the independent external display)</td>
<td>13-7</td>
</tr>
<tr>
<td>13.5.9 Enabling PPV Measurement</td>
<td>13-7</td>
</tr>
<tr>
<td>13.6 PAWP (only available when the N1 is used with the independent external display)</td>
<td>13-7</td>
</tr>
<tr>
<td>13.6.1 PAWP Equipment to Patient Connection</td>
<td>13-8</td>
</tr>
<tr>
<td>13.6.2 Preparing to Measure PAWP</td>
<td>13-8</td>
</tr>
<tr>
<td>13.6.3 Measuring PAWP</td>
<td>13-9</td>
</tr>
</tbody>
</table>
16 Clinical Assistive Applications (CAA) (only available when the N1 is used with the independent external display) 16 - 1

16.1 Early Warning Score (EWS) ........................................................................................................ 16 - 1
  16.1.1 Displaying the EWS Numerics Area ......................................................................................... 16 - 1
  16.1.2 Accessing the EWS Screen ........................................................................................................ 16 - 2
  16.1.3 Performing EWS Scoring .......................................................................................................... 16 - 3
  16.1.4 Changing EWS Settings ........................................................................................................... 16 - 4

16.2 Glasgow Coma Scale (GCS) ........................................................................................................ 16 - 5
  16.2.1 Displaying the GCS Parameter Area .......................................................................................... 16 - 5
  16.2.2 Accessing the GCS Dialog ......................................................................................................... 16 - 6
  16.2.3 Performing GCS Scoring .......................................................................................................... 16 - 6
  16.2.4 Setting GCS Scoring Interval ................................................................................................... 16 - 7
  16.2.5 Reviewing GCS Trend Data .................................................................................................... 16 - 7

16.3 Reviewing Discharged Patients ............................................................................................. 15 - 9
  16.3.1 Checking the Data of a Discharged Patient .............................................................................. 15 - 9
  16.3.2 Checking the Information of a Discharged Patient .................................................................. 15 - 9

17 Calculation (only available when the N1 is used with the independent external display) 17 - 1

17.1 Calculation Overview ............................................................................................................. 17 - 1
17.2 Calculation Safety Information .......................................................................................... 17 - 1
17.3 Drug Calculations .............................................................................................................. 17 - 1
  17.3.1 Performing Drug Calculations ............................................................................................... 17 - 1
  17.3.2 Checking the Titration Table .................................................................................................. 17 - 2
  17.3.3 Drug Calculation Formula ..................................................................................................... 17 - 2
  17.3.4 Titration Table Calculation Formula ..................................................................................... 17 - 2

17.4 Hemodynamic Calculations ............................................................................................... 17 - 3
  17.4.1 Performing Hemodynamic Calculations .................................................................................. 17 - 3
  17.4.2 Input Parameters for Hemodynamic Calculations ................................................................. 17 - 3
  17.4.3 Calculated Parameters and Formulas for Hemodynamic Calculations ................................ 17 - 3

17.5 Oxygenation Calculations .................................................................................................. 17 - 4
  17.5.1 Performing Oxygenation Calculations ................................................................................... 17 - 4
  17.5.2 Input Parameters for Oxygenation Calculations .................................................................... 17 - 5
  17.5.3 Calculated Parameters and Formulas for Oxygenation Calculations .................................. 17 - 5

17.6 Ventilation Calculations ...................................................................................................... 17 - 6
  17.6.1 Performing Ventilation Calculations ....................................................................................... 17 - 6
  17.6.2 Input Parameters for Ventilation Calculations ...................................................................... 17 - 6
  17.6.3 Calculated Parameters and Formulas for Ventilation Calculations ................................... 17 - 6

17.7 Renal Calculations ............................................................................................................. 17 - 7
  17.7.1 Performing Renal Calculations ............................................................................................. 17 - 7
  17.7.2 Calculated Parameters and Formulas for Renal Calculations ............................................. 17 - 7
  17.7.3 Calculated Parameters and Formulas for Renal Calculations ............................................. 17 - 8

18 Printing .................................................................................................................................. 18 - 1

18.1 Supported Printer ............................................................................................................... 18 - 1
18.2 End Case Reports .................................................................................................................. 18 - 1
  18.2.1 Printing the End Case Report ............................................................................................... 18 - 1
  18.2.2 Setting a Report as An End Case Report .............................................................................. 18 - 1
# 18 Managing Configurations

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.1 Configuration Introduction</td>
<td>20 - 1</td>
</tr>
<tr>
<td>18.2 Changing the Department</td>
<td>20 - 1</td>
</tr>
<tr>
<td>18.3 Setting Default Patient Category</td>
<td>20 - 1</td>
</tr>
<tr>
<td>18.4 Setting Default Configuration</td>
<td>20 - 1</td>
</tr>
<tr>
<td>18.5 Saving Current Settings</td>
<td>20 - 2</td>
</tr>
<tr>
<td>18.6 Setting Default Configuration</td>
<td>20 - 2</td>
</tr>
<tr>
<td>18.7 Transferring a Configuration</td>
<td>20 - 2</td>
</tr>
<tr>
<td>18.8 Printing Configurations</td>
<td>20 - 3</td>
</tr>
<tr>
<td>18.9 Transferring a Configuration</td>
<td>20 - 3</td>
</tr>
</tbody>
</table>

# 19 Using the On-Screen Timers

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.1 Displaying Timers</td>
<td>19 - 1</td>
</tr>
<tr>
<td>19.2 Controlling the Timer</td>
<td>19 - 1</td>
</tr>
<tr>
<td>19.3 Setting the Timer</td>
<td>19 - 1</td>
</tr>
</tbody>
</table>

# 20 Managing Configurations

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.1 Configuration Introduction</td>
<td>20 - 1</td>
</tr>
<tr>
<td>20.2 Changing the Department</td>
<td>20 - 1</td>
</tr>
<tr>
<td>20.3 Setting Default Patient Category</td>
<td>20 - 1</td>
</tr>
<tr>
<td>20.4 Setting Default Configuration</td>
<td>20 - 1</td>
</tr>
<tr>
<td>20.5 Saving Current Settings</td>
<td>20 - 2</td>
</tr>
<tr>
<td>20.6 Deleting a Configuration</td>
<td>20 - 2</td>
</tr>
<tr>
<td>20.7 Transferring a Configuration</td>
<td>20 - 2</td>
</tr>
<tr>
<td>20.8 Printing Configurations</td>
<td>20 - 3</td>
</tr>
<tr>
<td>20.9 Modifying Configuration Password</td>
<td>20 - 3</td>
</tr>
</tbody>
</table>

# 21 Password-protected User Settings

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.1 Setting the Device Location</td>
<td>21 - 1</td>
</tr>
<tr>
<td>21.2 Changing Patient Management Settings</td>
<td>21 - 1</td>
</tr>
<tr>
<td>21.3 Selecting Displayed Patient Information</td>
<td>21 - 1</td>
</tr>
<tr>
<td>21.4 Auto Discharging a Patient after Monitor Power Off</td>
<td>21 - 2</td>
</tr>
<tr>
<td>21.5 Setting Patient Location Options for the Discharge Screen</td>
<td>21 - 2</td>
</tr>
<tr>
<td>21.6 Selecting Whether a Prompt is Required When Auto Deleting Discharged Patients</td>
<td>21 - 2</td>
</tr>
</tbody>
</table>
21.3 Changing the Alarm Settings ............................................................................................................. 21 - 3
  21.3.1 Setting Alarm Tone Properties ........................................................................................................ 21 - 3
  21.3.2 Setting Alarm Pausing and Resetting Properties ....................................................................... 21 - 4
  21.3.3 Defining the Pause Function ......................................................................................................... 21 - 4
  21.3.4 Latching Physiological Alarms .................................................................................................... 21 - 5
  21.3.5 Changing Remote Alarm Settings ............................................................................................... 21 - 5
  21.3.6 Changing Alarm Priority Settings ............................................................................................... 21 - 7
  21.3.7 Changing Alarm Delay Settings ................................................................................................. 21 - 8
  21.3.8 Adjusting the Alarm Light Brightness ......................................................................................... 21 - 9
  21.3.9 Changing Other Alarm Settings ................................................................................................. 21 - 9

21.4 Changing CAA Settings (only available when the N1 is used with the independent external display) ........21 - 10
  21.4.1 Changing EWS Settings .............................................................................................................. 21 - 10
  21.4.2 Setting GCS Threshold for Each Consciousness Level ................................................................. 21 - 11

21.5 Changing Module Settings .................................................................................................................. 21 - 11
  21.5.1 Selecting the ECG Standard ........................................................................................................ 21 - 11
  21.5.2 Changing the QTc Formula ......................................................................................................... 21 - 11
  21.5.3 Setting the 12-Lead Order Switch .............................................................................................. 21 - 11
  21.5.4 Calibrating ECG ......................................................................................................................... 21 - 11
  21.5.5 Setting Parameter Measurement Timeout .................................................................................. 21 - 12
  21.5.6 Setting Flow Rate (For Sidestream CO₂ Module Without O₂) .................................................. 21 - 12

21.6 Setting the Printer ........................................................................................................................................ 21 - 12
  21.6.1 Setting the Printer ....................................................................................................................... 21 - 12
  21.6.2 Setting the Report Type ............................................................................................................. 21 - 12
  21.6.3 Setting Patient Information on General (Non-12-lead) Reports ................................................... 21 - 13
  21.6.4 Setting Patient Information on 12-lead ECG Reports ................................................................. 21 - 13
  21.6.5 Configuring the Name of PDF Files .......................................................................................... 21 - 13
  21.6.6 Showing the Second Mark ........................................................................................................ 21 - 13
  21.6.7 Setting Parameter Unit .............................................................................................................. 21 - 14

21.7 Enabling Auto Daylight Savings Time .................................................................................................. 21 - 14

21.8 Viewing Version Information .............................................................................................................. 21 - 14

21.9 Checking Battery Information .............................................................................................................. 21 - 14

21.10 Changing Scanner Settings ................................................................................................................. 21 - 14
  21.10.1 Establish the Relationship between Patient Demographics and 2D Barcode Fields (for the Mindray Custom 2D Barcode Reader) .................................................................................. 21 - 14
  21.10.2 Setting the Barcode Reader Information .................................................................................. 21 - 15
  21.10.3 Identifying the Barcode Reader (for the non-Mindray Custom 2D Barcode Reader) ......................... 21 - 15
  21.10.4 Selecting Patient Information Read by the Barcode Reader (for the Mindray Custom 2D Barcode Reader) ........ 21 - 15

21.11 Configuring the Network .................................................................................................................... 21 - 15
  21.11.1 Network Safety Information ....................................................................................................... 21 - 16
  21.11.2 Setting the Wireless Network .................................................................................................. 21 - 16
  21.11.3 Selecting WLAN Band and Channels ....................................................................................... 21 - 16
  21.11.4 Managing Certifications .......................................................................................................... 21 - 17
  21.11.5 Setting Multicast Parameters .................................................................................................. 21 - 17
  21.11.6 Setting the Network Service Quality Level ............................................................................... 21 - 17
  21.11.7 Using the ADT Gateway ........................................................................................................... 21 - 17
  21.11.8 Sending Realtime Data, Waveforms and Alarms via HL7 Protocol ........................................... 21 - 17
  21.11.9 Selecting Data Encryption Type ............................................................................................... 21 - 18
  21.11.10 Disabling the Broadcasting Patient Demographics Function .................................................. 21 - 18
21.12 MLDAP ............................................................................................................................................................................21 - 18
21.12.1 Setting MLDAP ............................................................................................................................................................................21 - 18
21.12.2 Testing MLDAP Server Connection ...........................................................................................................................................21 - 19
21.12.3 Selecting Password for User Authentication ..........................................................................................................................21 - 19
21.12.4 Setting the Password Timeout Period ......................................................................................................................................21 - 19
21.13 Connecting the Monitor to the CMS ..............................................................................................................................................21 - 19
21.13.1 Setting the CMS ............................................................................................................................................................................21 - 20
21.13.2 Selecting a CMS ............................................................................................................................................................................21 - 20
21.14 Connecting the eGateway .................................................................................................................................................................21 - 20
21.15 Setting the Dock ....................................................................................................................................................................................21 - 20
21.15.1 Setting the Work Mode ................................................................................................................................................................21 - 20
21.15.2 Setting the Net Setting Type .........................................................................................................................................................21 - 20
21.15.3 Setting the Network of the Dock ...............................................................................................................................................21 - 21
21.15.4 Setting the External Display .........................................................................................................................................................21 - 22
21.16 Defining Other Functions .................................................................................................................................................................21 - 22
21.16.1 Setting Notch Filter Frequency ......................................................................................................................................................21 - 22
21.16.2 Setting Mouse Sensitivity ...............................................................................................................................................................21 - 22
21.16.3 Setting the SpO2 Tone Mode ..........................................................................................................................................................21 - 23
21.16.4 Selecting the Language ...............................................................................................................................................................21 - 23
21.16.5 Switching On or Off a Parameter ................................................................................................................................................21 - 23
21.16.6 Setting If Setting Parameter Switches is Protected ....................................................................................................................21 - 24
21.16.7 Setting If Parameter Switch is Influenced by Configuration ..................................................................................................21 - 24
21.16.8 Hiding Undesired Review Tabs ...................................................................................................................................................21 - 24
22 Battery ........................................................................................................................................................................................................22 - 1
22.1 Battery Introduction .............................................................................................................................................................................22 - 1
22.2 Battery Safety Information ...............................................................................................................................................................22 - 1
22.3 Installing the Battery ..........................................................................................................................................................................22 - 1
22.4 Battery Indications ..............................................................................................................................................................................22 - 1
22.4.1 Battery LED .......................................................................................................................................................................................22 - 1
22.4.2 Battery Symbols ................................................................................................................................................................................22 - 2
22.4.3 Battery Power Indicator .................................................................................................................................................................22 - 2
22.4.4 Battery-related Alarms .................................................................................................................................................................22 - 2
22.4.5 Checking the Battery Information ...............................................................................................................................................22 - 3
22.5 Charging the Battery ..........................................................................................................................................................................22 - 3
22.6 Maintaining the Battery ...................................................................................................................................................................22 - 3
22.6.1 Conditioning the Battery ...............................................................................................................................................................22 - 3
22.6.2 Checking Battery Performance ...................................................................................................................................................22 - 3
22.7 Storing the Battery ..................................................................................................................................................................................22 - 4
22.8 Recycling the Battery ............................................................................................................................................................................22 - 4
23 Care and Cleaning ....................................................................................................................................................................................23 - 1
23.1 Care and Cleaning Introduction .........................................................................................................................................................23 - 1
23.2 Care and Cleaning Safety Information .........................................................................................................................................23 - 1
23.3 Cleaning and Disinfecting the Equipment and Mounting Kits ................................................................................................23 - 2
23.3.1 Approved Cleaning and Disinfecting Agents .................................................................................................................................23 - 2
23.3.2 Cleaning the Equipment and Mounting Kits .................................................................................................................................23 - 3
23.3.3 Disinfecting the Equipment and Mounting Kits ............................................................................................................................23 - 4
25 Accessories ..................................................................................................................................................................... 25 - 1

25.1 ECG Accessories ..................................................................................................................................................................... 25 - 1
   25.1.1 ECG Electrodes Available for Purchase ..................................................................................................................................................................... 25 - 1
   25.1.2 12-Pin Trunk Cables Available for Purchase ..................................................................................................................................................................... 25 - 2
   25.1.3 12-Pin Trunk Cables Also Compatible ..................................................................................................................................................................... 25 - 2
   25.1.4 3-lead ECG Leadwires Available for Purchase ..................................................................................................................................................................... 25 - 2
   25.1.5 3-lead ECG Leadwires Also Compatible ..................................................................................................................................................................... 25 - 3
   25.1.6 5-lead ECG Leadwires Available for Purchase ..................................................................................................................................................................... 25 - 3
   25.1.7 5-lead ECG Leadwires Also Compatible ..................................................................................................................................................................... 25 - 3
   25.1.8 6-lead ECG Leadwires Available for Purchase ..................................................................................................................................................................... 25 - 4
   25.1.9 12-lead ECG Chest Leadwires Available for Purchase ..................................................................................................................................................................... 25 - 4
   25.1.10 12-lead ECG Leadwires Also Compatible ................................................................................................................................................................. 25 - 4

25.2 SpO₂ Accessories .................................................................................................................................................................. 25 - 4
   25.2.1 Extension Cables and Adapter Cables Available for Purchase ..................................................................................................................................................................... 25 - 4
   25.2.2 Extension Cables and Adapter Cables Also Compatible ..................................................................................................................................................................... 25 - 4
   25.2.3 Masimo SpO₂ RD Set Sensors Available for Purchase ..................................................................................................................................................................... 25 - 5
   25.2.4 Masimo SpO₂ LNCS Sensors Also Compatible ..................................................................................................................................................................... 25 - 5
   25.2.5 Nellcor SpO₂ Sensors Also Compatible ..................................................................................................................................................................... 25 - 6

25.3 Temp Accessories ................................................................................................................................................................. 25 - 6
   25.3.1 Temp Cable Available for Purchase ..................................................................................................................................................................... 25 - 6
   25.3.2 Temp Cable Also Compatible ..................................................................................................................................................................... 25 - 6
   25.3.3 Temp Probes Available for Purchase ..................................................................................................................................................................... 25 - 6
   25.3.4 Temp Probes Also Compatible ..................................................................................................................................................................... 25 - 7

25.4 NIBP Accessories .................................................................................................................................................................... 25 - 7
   25.4.1 NIBP Hoses Available for Purchase ..................................................................................................................................................................... 25 - 7
   25.4.2 Cuffs Available for Purchase ..................................................................................................................................................................... 25 - 7

25.5 IBP Accessories ..................................................................................................................................................................... 25 - 8

24 Maintenance ........................................................................................................................................................................... 24 - 1

24.1 Maintenance Introduction ................................................................................................................................................................. 24 - 1
24.2 Maintenance Safety Information ................................................................................................................................................................. 24 - 1
24.3 Maintenance and Testing Schedule ................................................................................................................................................................. 24 - 2
24.4 Checking System Software Version ................................................................................................................................................................. 24 - 2
24.5 Testing Methods and Procedures ................................................................................................................................................................. 24 - 2
   24.5.1 Performing Visual Inspection ..................................................................................................................................................................... 24 - 2
   24.5.2 Performing Power-on Test ..................................................................................................................................................................... 24 - 3
   24.5.3 Testing the Network Printer ..................................................................................................................................................................... 24 - 3
   24.5.4 Checking the Battery ..................................................................................................................................................................... 24 - 3
24.6 NIBP Maintenance ..................................................................................................................................................................... 24 - 3
   24.6.1 NIBP Leakage Test ..................................................................................................................................................................... 24 - 3
   24.6.2 NIBP Accuracy Test ..................................................................................................................................................................... 24 - 3
24.7 Disposing of the Monitor ................................................................................................................................................................. 24 - 3
A Product Specifications ........................................................................................................................................... A - 1

A.1 Monitor Safety Specifications ................................................................................................................................. A - 1
A.2 Physical Specifications .................................................................................................................................................. A - 1
A.3 Environmental Specifications .................................................................................................................................. A - 2
A.4 Power Supply Specifications ..................................................................................................................................... A - 3
    A.4.1 External Power Supply Specifications .................................................................................................................... A - 3
    A.4.2 Battery Specifications ........................................................................................................................................ A - 3
A.5 Display Specifications ................................................................................................................................................. A - 4
A.6 Touchscreen Specifications ........................................................................................................................................ A - 4
A.7 LEDs .......................................................................................................................................................................... A - 4
    A.7.1 Main Unit ......................................................................................................................................................... A - 4
    A.7.2 Dock .............................................................................................................................................................. A - 4
    A.7.3 Transport Dock ........................................................................................................................................ A - 4
    A.7.4 AC Adapter ................................................................................................................................................. A - 4
A.8 Audio Indicator .......................................................................................................................................................... A - 5
A.9 Monitor Interface Specifications ............................................................................................................................. A - 5
    A.9.1 Interface Specifications of the Main Unit ........................................................................................................ A - 5
    A.9.2 Interface Specifications of the Modular Rack .................................................................................................. A - 5
A.10 Signal Outputs Specifications ................................................................................................................................ A - 6
A.11 Data Storage ............................................................................................................................................................ A - 6
A.12 Out-Of-Hospital Transport - Standards Compliance .......................................................................................... A - 7
A.13 Wi-Fi Specifications ................................................................................................................................................ A - 8
    A.13.1 Wi-Fi Technical Specifications .......................................................................................................................... A - 8
    A.13.2 Wi-Fi Performance Specifications .................................................................................................................. A - 8
A.14 Measurement Specifications ................................................................................................................................ A - 9
    A.14.1 ECG Specifications ........................................................................................................................................ A - 9
    A.14.2 Resp Specifications ...................................................................................................................................... A - 12
    A.14.3 SpO2 Specifications ...................................................................................................................................... A - 12
    A.14.4 PR Specifications ....................................................................................................................................... A - 14
    A.14.5 Temp Specifications .................................................................................................................................... A - 15
    A.14.6 NIBP Specifications ................................................................................................................................... A - 15
    A.14.7 IBP Specifications ..................................................................................................................................... A - 16
    A.14.8 CO2 Specifications .................................................................................................................................. A - 17

B EMC and Radio Regulatory Compliance .................................................................................................................. B - 1
1 Safety

1.1 Safety Information

WARNING

• Indicates a potential hazard or unsafe practice that, if not avoided, could result in death or serious injury.

CAUTION

• Indicates a potential hazard or unsafe practice that, if not avoided, could result in minor personal injury or product/property damage.

NOTE

• Provides application tips or other useful information that does not involve patient or user risk.

1.1.1 Warnings

WARNING

• Patient with a pacemaker – On ventricular paced patients, episodes of Ventricular Tachycardia may not always be detected. Do not rely entirely upon the system's automated arrhythmia detection algorithm. Keep pacemaker patients under close surveillance.
• This equipment is used for a single patient at a time.
• To avoid explosion hazards, do not use the equipment in the presence of oxygen-rich atmospheres, flammable anesthetics, or other flammable agents.
• Do not touch the equipment's metal parts or connectors when in contact with the patient; otherwise patient injury may result.
• Never mix patient electrode types or brands. Dissimilar metals or other incompatibilities may cause considerable baseline drift and may increase trace recovery time after defibrillation.
• To reduce the hazard of burns during high-frequency surgical procedure, ensure that the monitor’s cables and transducers never come into contact with the electro-surgery unit (ESU).
• The neutral electrode of the electro-surgery unit (ESU) shall properly contact the patient. Otherwise, burns may result.
• MR unsafe: the N1 monitor is not intended to be used within the Magnetic Resonance (MR) environment.
• Before connecting the equipment to the mains power, ensure that the voltage and frequency ratings of the power line are the same as those indicated on the equipment's label or in this manual.
• Before putting the system into operation, the operator must verify that the equipment, connecting cables, and accessories are in correct working order and operating condition.
• To avoid risk of electric shock, the equipment must only be connected to mains power with protective earth, or operated on battery power.
• Do not touch the patient and live parts simultaneously. Otherwise patient injury may result.
• Do not touch the patient or metal parts in contact with the patient during defibrillation. Otherwise serious injury or death could result.
• Do not open the equipment housings. All servicing and future upgrades must be carried out by trained and authorized personnel.
• Do not rely exclusively on the audible alarm system for patient monitoring. Turning the alarm volume to a low level or off may result in a hazard to the patient. Always keep the patient under close surveillance.

• Alarm settings should be customized according to patient situations.

• Do not place the equipment or accessories in any position that might cause it to fall on the patient.

• Do not start or operate the equipment unless the setup was verified to be correct.

• To avoid inadvertent disconnection, route all cables in a way to prevent a stumbling hazard. Wrap and secure excess cabling to reduce risk of entanglement by patients or personnel.

• The physiological data and alarm messages displayed on the equipment are for reference only and cannot be directly used for diagnostic interpretation. The equipment should not be used as the sole basis for medical decisions. It must be used in conjunction with clinical signs and symptom. If any measurement seems questionable, first check the patient’s vital signs by alternate means and then check the equipment for proper functioning.

1.1.2 Cautions

CAUTION

• Use only parts and accessories specified in this manual.

• Disposable accessories are not designed to be reused. Reuse may cause a risk of contamination and affect the measurement accuracy.

• Ensure that the equipment is supplied with continuous electric power during operation from the mains power or batteries. Sudden power failure may cause data loss.

• When no battery is installed, ensure that the monitor is supplied with continuous electric power during operation. Sudden power failure may lead to data loss.

• This equipment is intended for single patient use.

• Store and use the equipment in specified environmental condition. The monitor and accessories may not meet the performance specification due to aging, stored or used outside the specified temperature and humidity range.

• Magnetic and electrical fields are capable of interfering with the proper performance of the equipment. For this reason make sure that all external devices operated in the vicinity of the equipment comply with the relevant EMC requirements. Mobile phones, X-ray equipment, and MRI devices are possible sources of interference as they may emit higher levels of electromagnetic radiation.

• Always install or carry the equipment properly to avoid damage caused by drops, impacts, strong vibrations or other mechanical forces.

• Dry the equipment immediately in case of rain or water spray.

• Some settings are password protected and can only be changed by authorized personnel. Contact your department manager or biomedical engineering department for the passwords used at your facility.

• Do not loop the patient cabling into a tight coil or wrap around the device, as this can damage the patient cabling.

• Dispose of the package material as per the applicable waste control regulations. Keep it out of children’s reach.

• At the end of its service life, the equipment, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have any questions concerning disposal of the equipment, please contact Mindray.

1.1.3 Notes

NOTE

• The equipment software copyright is solely owned by Mindray. No organization or individual shall resort to modifying, copying, or exchanging it or to any other infringement on it in any form or by any means without due permission.
• Put the equipment in a location where it can be easily viewed and operated.
• The equipment uses a mains plug as isolation means to the mains power. Do not locate the equipment in a place difficult to access the mains plug.
• During normal use, the operator is expected to face the front of the equipment.
• Remove the battery before shipping the monitor or if it will not be used for an extended period of time.
• Remove the battery before transporting the equipment or if the equipment will not be used for a long time.
• The software was developed in compliance with IEC62304, to minimize the possibility of hazards arising from software errors.
• This manual describes all available features and options. The equipment configuration may not have all of them.
• Observance of this manual is a prerequisite for proper product performance and correct operation and ensures patient and operator safety.
• Keep this manual in the vicinity of the equipment so that it can be referenced when needed.

1.2 Equipment Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>General warning sign</td>
<td>📚</td>
<td>Refer to instruction manual/booklet</td>
</tr>
<tr>
<td>SN</td>
<td>Serial number</td>
<td>REF</td>
<td>Catalogue number</td>
</tr>
<tr>
<td>🕒</td>
<td>Date of manufacture</td>
<td>💼</td>
<td>Manufacturer</td>
</tr>
<tr>
<td>📠</td>
<td>USB connector</td>
<td>IPX1</td>
<td>Protected against vertically falling water drops per IEC 60529</td>
</tr>
<tr>
<td>IP44</td>
<td>IP44: protected against ingress of foreign objects no less than 1.0 mm, and against access to hazardous parts with wire; protect against harmful effects of splashing water</td>
<td>IP22</td>
<td>IP22: protected against ingress of foreign objects no less than 12.5 mm and against access to hazardous parts with finger; protected against harmful effects of vertically falling water drops with the device tilted at any angle up to 15°</td>
</tr>
<tr>
<td>🌔</td>
<td>Battery indicator</td>
<td>📱</td>
<td>Computer network</td>
</tr>
<tr>
<td>🌙</td>
<td>Direct current</td>
<td>~</td>
<td>Alternating current</td>
</tr>
<tr>
<td>🍼</td>
<td>DEFIBRILLATION-PROOF TYPE CF APPLIED PART</td>
<td></td>
<td></td>
</tr>
<tr>
<td>🍼</td>
<td>DEFIBRILLATION-PROOF TYPE BF APPLIED PART</td>
<td></td>
<td></td>
</tr>
<tr>
<td>⚖️</td>
<td>Lock; tighten</td>
<td>→ ↔</td>
<td>IBP zero key</td>
</tr>
<tr>
<td>Symbol</td>
<td>Description</td>
<td>Symbol</td>
<td>Description</td>
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<tr>
<td></td>
<td>Locking</td>
<td></td>
<td>Unlocking</td>
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<tr>
<td></td>
<td>Direction and angle off rotation</td>
<td></td>
<td>Calibration</td>
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<tr>
<td></td>
<td>Start</td>
<td></td>
<td>Stop</td>
</tr>
<tr>
<td></td>
<td>Equipotentiality</td>
<td></td>
<td>Polarity of d.c. power connector</td>
</tr>
<tr>
<td></td>
<td>Menu</td>
<td></td>
<td>Video output</td>
</tr>
<tr>
<td></td>
<td>Gas outlet</td>
<td></td>
<td>Gas inlet</td>
</tr>
<tr>
<td></td>
<td>Power On/Off</td>
<td></td>
<td>Input/output</td>
</tr>
<tr>
<td></td>
<td>Authorised representative in the European Community</td>
<td></td>
<td>Non-ionizing electromagnetic radiation</td>
</tr>
<tr>
<td></td>
<td>Dispose of in accordance to your country's requirements</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 Equipment Introduction

2.1 Indications for Use

The BeneVision N1 Patient Monitor is intended for monitoring, displaying, reviewing, storing, alarming, and transferring of multiple physiological parameters including ECG (3-lead, 5-lead, 6-lead or 12-lead selectable, Arrhythmia Detection, ST Segment Analysis, QT Analysis, and Heart Rate (HR)), Respiration (Resp), Temperature (Temp), Pulse Oxygen Saturation (SpO2), Pulse Rate (PR), Non-invasive Blood Pressure (NIBP), Invasive Blood Pressure (IBP), Pulmonary Artery Wedge Pressure (PAWP), Carbon Dioxide (CO2) and Oxygen (O2). The system also provides an interpretation of resting 12-lead ECG.

All the parameters can be monitored on single adult, pediatric, and neonatal patients except for the following:

- The arrhythmia detection and PAWP is intended for adult and pediatric patients only

The BeneVision N1 monitor is to be used in healthcare facilities. It can also be used during patient transport inside and outside of the hospital environment. It should be used by clinical professionals or under their guidance. It should only be used by persons who have received adequate training in its use. It is not intended for home use.

2.2 Equipment Features

The monitor is intended to be used in a hospital environment including, but not limited to, ICU, CCU, PICU, Neonatology, RICU, emergency room, operating room, postoperative observation ward, etc.

The monitor can be used in two ways:

- As a stand-alone patient monitor, or
- As a multi-parameter module (MPM) for the Mindray BeneVision N22, BeneVision N19, BeneVision N17, BeneVision N15, or BeneVision N12 patient monitor, hereafter referred to as “the host monitor”.

In this manual, the N1 is generally referred to as “the monitor” except in the situation describing its use with a host monitor, where it is referred to as “the N1” to distinguish it from the host monitor.

2.3 Applied Parts

The applied parts of the monitor are:

- ECG electrode and leadwire
- SpO2 sensor
- Temp probe
- NIBP cuff
- IBP transducer
- CO2 sampling line/nasal sampling cannula, water trap, and mask
2.4 Main Unit

2.4.1 Front View

(1) Alarm lamp:
When a physiological alarm or technical alarm occurs, this lamp lights and flashes corresponding with the alarm priority:
- High priority alarms: the lamp quickly flashes red.
- Medium priority alarms: the lamp slowly flashes yellow.
- Low priority alarms: the lamp lights in cyan without flashing.

(2) Ambient light sensor
When screen brightness is set to auto, the system automatically adjusts screen brightness according to the strength of ambient light.

(3) Display

(4) Battery LED:
- Yellow: the battery is being charged.
- Green: the battery is fully charged.
- Flashing green: the monitor runs on battery power.
- Flashing yellow: the battery is malfunctioning.
- Off: no battery is installed, or the monitor is powered off and no external power is connected.

(5) External power supply indicator:
- On: when external power supply is connected.
- Off: when external power supply is not connected.
2.4.2 Left View

(1) Communication interface: used for communication between the N1 and host monitor (BeneVision N series monitor).

(2) Infrared filter: used for communication between the N1 and N series monitor if the communication interface does not work.

(3) Contact: used for receiving power supply from the host monitor (BeneVision N series monitor).

(4) Multi-pin connector: connects the N1 to the Modular Rack or Dock.

(5) External DC power input connector: connects the N1 to the AC adapter

NOTE

• To ensure good contact, clean the contacts regularly, as dust and dirt may collect on them. When cleaning the contacts, wipe them with cotton, dampened with alcohol. Using forceps is recommended.

• In the case of water spray, dry the Multi-pin connector of the N1 before connecting the N1 to the Modular Rack or Dock.
2.4.3 Right View

(1) Power switch
(2) Sample line connector for sidestream CO₂
(3) Gas outlet
(4) ECG cable connector
(5) SpO₂ sensor connector
(6) NIBP cuff connector
(7) Multifunctional connector: outputs analog ECG, IBP and defib synchronization signals.
(8) IBP cable connector
(9) Temperature probe connector

2.4.4 Bottom View

(1) Clip: fastens the N1 when N1 is in use with the host monitor, Dock or Modular Rack.
(2) Latch: locks the N1 when the N1 is in use with the host monitor, Dock or Modular Rack. Pressing here releases the N1 so that the N1 can be removed from the host monitor, Dock or Modular Rack.

2.5 Modular Rack

The Modular Rack is used to connect an N1 and an external parameter module as well as providing bed rail mounting capability. It can also be connected to the Dock.
2.5.1 Left View

(1) Release button: pressing this button releases the Modular Rack from the Dock.

(2) Multi-pin connector: connects the Modular Rack and Dock.

2.5.2 Right View

(1) Multi-pin connector: connects the Modular Rack and N1.

(2) Pogo pin: used for communication between the Modular Rack and external parameter module.

(3) Infrared filter: used for communication between the Modular Rack and external parameter module.

(4) Contact: power input connector of the external parameter module.
2.6 Dock

The Dock is used to connect the N1 or Modular Rack to provide power, charge the installed battery, and support connection to an external display, USB drive, network cables, and the BeneVision N series patient monitors.

2.6.1 Left View

(1) Symbol: indicates the direction and angle that Dock can rotate when Dock is fixed onto a transverse or a vertical rod.

(2) Pole mount seat: used to fix the pole mount to the Dock and then to a transverse or a vertical rod.

2.6.2 Right View

(1) Multi-pin connector: power input and communication connector of the N1.

(2) Connection status indicator: it is on when the N1 is properly connected to the Dock.

(3) External power supply indicator: it is on when the external AC power supply is connected.
2.6.3  Rear View

(1)  AC Power input connector

(2)  Equipotential grounding terminal: when using the monitor together with other devices, connect their equipotential grounding terminals together to eliminate the potential difference between them.

(3)  VGA connector: connects the external display

(4)  Host monitor connector: connects the N1 to the host monitor through a cable.

(5)  USB connector: connects USB devices.

(6)  Network connector: a standard RJ45 connector which connects the monitor to the CMS. It can also be used to transfer data.

2.7  External Parameter Modules

The monitor can connect the following external parameter modules to perform CO₂ monitoring through the Modular Rack.

- Sidestream CO₂ module
- Microstream CO₂ module
2.8 Installation

2.8.1 Installing the N1 or External Parameter Module into the Modular Rack

Install the N1, and an external parameter module if needed, to the Modular Rack as indicated below:

Firmly push the N1 or the external module until an audible click is heard indicating that the clip (refer to 2.4.4 Bottom View) engaged the Modular Rack. To ensure that the N1 or the external module is properly connected, try to pull the N1 or the external module outward. The N1 or the external module has properly engaged the Modular Rack if it cannot be pulled out.

NOTE

• To prevent the N1 or the external module from falling out of the Modular Rack, after inserting the N1 or the external module into the Modular Rack, always check that the N1 or the external module properly engaged the Modular Rack.

• When the external module is properly installed, it should be further fasten to the Modular Rack with the lock at the bottom of the module to ensure the engagement.

2.8.2 Removing the N1 or External Parameter Module from the Modular Rack

To remove the N1 or external parameter module, follow this procedure:

1. Press and hold the latch at the bottom of the N1 or parameter module. If the external module is locked to the Modular Rack, unlock it first.

2. Pull the N1 or parameter module out as indicated.
2.8.3 Installing the Modular Rack to the Dock
The Modular Rack can be installed to the Dock as indicated below:

A click is heard when the Modular Rack is pushed into place.

2.8.4 Removing the Modular Rack from the Dock
To remove the Modular Rack from the Dock, follow this procedure:
1. Press and hold down the release button at the top of the Modular Rack.
2. Pull the Modular Rack out as indicated.

**CAUTION**
- To prevent the Dock from falling off, do not press the release button while transporting the N1 with the Modular Rack and Dock.

2.8.5 Installing the N1 to the Dock
The N1 can also be installed directly to the Dock as shown below:
Firmly push the N1 until an audible click is heard indicating that the clip (refer to 2.4.4 Bottom View) engaged the Dock. To ensure that the N1 is properly connected, try to pull the N1 outward. The N1 has properly engaged the Dock if it cannot be pulled out.

### 2.8.6 Removing the N1 from the Dock

To remove the N1 from the Dock, follow this procedure:

1. Press and hold the latch at the bottom of the N1.
2. Pull the N1 out as indicated.

### 2.9 N1 in Use with a Host Monitor

When the N1 is connected to the BeneVision N series monitor, the N1 works as the parameter module while BeneVision N series monitor works as the host monitor. For more information, see section 3.7.2 Module Mode.

The N1 can be connected to the host monitor through the following parts:

- The module rack of the host monitor
- The Satellite Module Rack (SMR)
- The Dock

#### 2.9.1 Connecting the N1 to the Host Monitor through the Module Rack

To connect the N1 to the module rack of the host monitor, follow this procedure:

1. Insert the N1 to the host monitor’s module rack. Firmly push the N1 until an audible click is heard indicating that the clip (refer to 2.4.4 Bottom View) engaged the module rack.
2. To ensure that N1 is properly connected, try to pull N1 outward. The N1 has properly engaged the module rack if it cannot be pulled out.

To remove the N1 from the module rack of the host monitor, lift the latch (refer to 2.4.4 Bottom View) at the bottom of the N1 and pull the N1 out.

CAUTION

- To prevent the N1 from falling out, after inserting the N1 into the module rack, always check that the N1 properly engaged the module rack.
- To prevent the N1 from falling, catch it with another hand while pulling it out from the module rack.

NOTE

- There is no module rack for the BeneVision N22 or BeneVision N19 monitors. The N1 can be connected to the BeneVision N22 or BeneVision N19 monitor through the SMR or Dock.

2.9.2 Connecting the N1 to the Host Monitor through the Satellite Module Rack (SMR)

To connect the N1 to the host monitor through the SMR, follow this procedure:

1. Connect the SMR to the host monitor.
2. Insert the N1 to the SMR. Firmly push the N1 until an audible click is heard indicating that the clip (refer to 2.4.4 Bottom View) engaged the SMR.
3. To ensure that the N1 is properly connected, try to pull the N1 outward. The N1 has properly engaged the module rack if it cannot be pulled out.

To remove the N1 from the SMR, lift the latch (refer to 2.4.4 Bottom View) at the bottom of the N1 and pull the N1 out.

CAUTION

- To prevent N1 from falling out, after inserting the N1 into the SMR, always check that the N1 properly engaged the SMR.
- To prevent the N1 from falling, catch it with another hand while pulling it out from the SMR.

2.9.3 Connecting the N1 to the Host Monitor through the Dock

To connect the N1 to the host monitor through the Dock, follow this procedure:

1. Connect the N1 to the Dock.
2. Connect the host monitor connector of the Dock with the SMR connector of the host monitor using the dock data cable.
2.10 N1 in Use with the Transport Dock

The N1 can be used with the Transport Dock to transport a patient via ambulance, airplane fuselage or helicopter fuselage. For the installation instructions of the N1 and Transport Dock, refer to the Transport Dock Indication for Use (PN: H-046-011365-00).

**WARNING**

- The monitor must only be connected to mains power with protective earth, and the connection should be performed by qualified service personnel.
- Ensure that the external power system has secure protective earth when the monitor is used together with the Transport Dock.
- Verify that the connection of protective earth and the external power system is securely connected when installing the Transport Dock.

2.11 Input Devices

The monitor allows data entry through touchscreen, keyboard, mouse, and barcode reader.

2.12 Printing Devices

Use only Mindray specified printers to output patient information and data.
3 Getting Started

3.1 Equipment Preparation Safety Information

WARNING

- Use only installation accessories specified by Mindray.
- Connect only approved devices to this equipment. Devices connected to the equipment must meet the requirements of the applicable IEC standards (e.g. IEC 60950 safety standards for information technology equipment and IEC 60601-1 safety standards for medical electrical equipment). The system configuration must meet the requirements of the IEC 60601-1 medical electrical systems standard. Any personnel who connect devices to the equipment’s signal input/output port are responsible for providing evidence that the safety certification of the devices has been performed in accordance to the IEC 60601-1. If you have any questions, please contact Mindray.
- If it is not evident from the equipment specifications whether a particular combination with other devices is hazardous, for example, due to summation of leakage currents, please consult the manufacturer or an expert in the field. A determination must be made that the proposed combination will not negatively affect the devices themselves or the patient's safety.

CAUTION

- The equipment should be installed by Mindray authorized personnel.
- When disposing of the packaging material, be sure to observe the applicable waste control regulations and keep it out of children's reach.
- Before use, verify whether the packages are intact, especially the packages of single use accessories. In case of any damage, do not apply it to patient.
- Avoid rough handling during transport.

NOTE

- Put the equipment in a location where it can easily be viewed and operated.
- Keep this manual in the vicinity of the equipment so that it can be conveniently referenced when needed.
- Save the packing case and packaging material as they can be used if the equipment must be reshipped.
- Many settings in the patient monitor are password protected. It is recommended to change the default passwords and keep the passwords safe. Passwords should only be changed by authorized personnel. Contact your department manager or biomedical engineering department for the passwords used at your facility.

3.2 Unpacking and Checking

Before unpacking, examine the packaging carefully for signs of damage. If any damage is detected, contact the carrier or Mindray.

If the packing case is intact, open the package and remove the equipment and accessories carefully. Check all materials against the packing list and check for any mechanical damage. Contact Mindray in case of any problems.

NOTE

- If the N1 purchased contains the internal CO₂ module, connect the CO₂ adapter to the CO₂ receptacle soon after unpacking the monitor to avoid losing the CO₂ adapter.
3.3 Environmental Requirements

The operating environment of the equipment must meet the requirements specified in this manual.

The environment where the equipment is used shall be reasonably free from noises, vibration, dust, corrosive, flammable and explosive substances. Moreover, to maintain good ventilation, the equipment shall be at least 2 inches (5cm) away from around the cabinet.

When the equipment is moved from one place to another, condensation may occur as a result of temperature or humidity differences. In this case, never start the system before the condensation evaporates.

**CAUTION**

- Make sure that the equipment operating environment meets the specific requirements. Otherwise unexpected consequences, e.g. damage to the equipment, could result.

3.4 Setting Up the Equipment

Observance of this manual is a prerequisite for proper product performance and correct operation. It ensures patient and operator safety.

3.4.1 Connecting the AC Mains

The monitor can be powered by AC power supply when it is connected to the AC adapter or Dock. Before connecting the equipment to the AC mains, check that the voltage and frequency ratings of the power line are the same as those indicated on the AC adapter or Dock.

3.4.1.1 Connecting the AC Mains through the AC Adapter

To connect the N1 to the AC power source through the AC adapter, follow this procedure:

1. Connect the N1 to the AC adapter.
2. Connect the female end of the power cord to the AC adapter, and the male end of the power cord to a wall AC outlet.
3. Check that the external power supply indicator is on.

The external power supply indicator lies in the lower right corner of the display. When the AC mains is not connected, the external power supply indicator is off. When AC mains is connected, the external power supply indicator is illuminated in green.

3.4.1.2 Connecting the AC Mains through the Dock

To connect the N1 to the AC power source through the Dock, follow this procedure:

1. Connect the N1 to the Dock.
2. Connect the female end of the power cord to the AC power input of the Dock, and the male end of the power cord to a wall AC outlet.
3. Check that the external power supply indicator of the N1 and Dock are on.

**WARNING**

- Operate the N1 on battery power if the integrity of the protective earth conductor or the protective earthing system in the installation is in doubt.

**CAUTION**

- Always use the accompanying power cord delivered with the monitor.
- Always use the AC adapter specified by Mindray.
- Before connecting the equipment to the AC mains, check that the voltage and frequency ratings of the power line are the same as those indicated on the AC adapter and Dock.
3.4.2 Connecting the Input Devices

Connect the mouse, keyboard, and/or barcode reader to the USB ports on the rear of the Dock if necessary.

3.4.3 Installing the External Parameter Module

If an external parameter module is needed, refer to section 2.8.1 Installing the N1 or External Parameter Module into the Modular Rack for installation.

3.4.4 Turning on the Monitor

Before beginning measurements, turn on the monitor, perform the following inspections:

1. Check the monitor for any mechanical damage. Make sure that all external cables, plug-ins and accessories are properly connected.
2. Connect the monitor to the AC power source using AC adapter or Dock. Make sure the battery power is sufficient if the monitor is powered by the battery.
3. Press the power switch to turn on the monitor.

The monitor automatically performs a self test at startup. Check that the alarm tone is heard and the alarm lamp illuminates, one after the other, in red, yellow, and cyan. This indicates that the visible and audible alarm indicators function correctly.

CAUTION

- Check that visual and auditory alarm signals are presented correctly when the equipment is powered on. Do not use the patient monitor for any monitoring procedure on a patient if you suspect it is not working properly, or if it is mechanically damaged. Contact your service personnel or Mindray.

NOTE

- For first use, connect the monitor to the AC power source and then turn on the monitor to activate the battery.
- The time for the monitor to warm up from the minimum storage temperature between uses until the monitor is ready for its intended use is 10 minutes when the ambient temperature is 20 °C.
- The time for the monitor to cool down from the maximum storage temperature between uses until the monitor is ready for its intended use is 10 minutes when the ambient temperature is 20 °C.

3.5 Operation and Navigation

Everything needed to operate the monitor is on its screen. Almost every element on the screen is interactive. Screen elements include parameter values, waveforms, quick keys, information fields, alarms fields and dialogs. Often you can access the same element in different ways. For example, you can access a parameter dialog by selecting the corresponding numeric area or waveform area, or by selecting the Main Menu quick key → from the Parameters column select Setup.

3.5.1 Using the Touchscreen

You can use the touchscreen to select a screen element by pressing directly on the monitor’s screen. To avoid accidental use, the touchscreen is locked in the following situations:

- The touchscreen is not used in 60 seconds when the N1 runs on battery and is not connected to an external display.
- Select the Unlock quick key , and swipe the slider up as instructed.
When the touchscreen is locked, the quick key changes to 
. To unlock the touchscreen, touch anywhere on the touchscreen and swipe the slider up as instructed.

**NOTE**
- Wipe off any water on the touchscreen in case of rain or water spray.

### 3.5.2 Using the On-Screen Keyboard

The on-screen keyboard enables information entry:
- Enter the information by selecting one character after another.
- Select the Backspace key \( \leftarrow \) to delete single characters or select \( \rightarrow \) to delete the entire entry.
- Select the Caps Lock key \( \Leftrightarrow \) to access uppercase letters.
- Select the Enter key \( \rightarrow \) to confirm the entry and close the on-screen keyboard.

### 3.5.3 Using the Barcode Reader

The monitor supports both linear (1D) barcode reader and two-dimension (2D) barcode reader. The barcode reader is connected to the monitor through the USB connector on the rear of the Dock.

**NOTE**
- Use the Mindray custom barcode reader to obtain all the available patient information from both the 2D and 1D barcodes. Using other barcode readers can only output the patient’s medical record number (MRN) and visit number.

#### 3.5.3.1 Clearing Old Data Formats (for the Mindray Custom 2D Barcode Reader)

If using the Mindray custom 2D barcode reader (Model HS-1R or HS-1M), before using it for the first time, clear old data formats and configure the barcode reader. To do so, follow this procedure:

1. Scan the engineering barcode to clear the previous data format.
2. Scan the 2D engineering barcode which contains your hospital's data format.

**NOTE**
- Contact the scanner manufacturer or Mindray to obtain the engineering barcodes for clearing data formats and programming the hospital's data format.
3.6 Screen Display

The following figure shows the normal screen:

- (1) Patient information area: displays patient category and gender. The displayed patient information is configurable. Selecting this area enters the **Patient Management** dialog. For more information, see 5.2.2 Editing Patient Information.
- (2) Patient information area: displays patient information, including department, room number, bed number, and so on. The displayed patient information is configurable. Selecting this area enters the **Patient Management** dialog. For more information, see 5.2.2 Editing Patient Information.
- (3) Technical alarm information area: displays technical alarm message or prompt message.
- (4) The current configuration
- (5) Physiological alarm information area: displays physiological alarm message.
- (6) System status information area: displays alarm symbol, battery status, network status, currently connected CMS, and system time. For more information, see 3.6.1 On-screen Symbols.
- (7) Quick key area: displays quick keys.
- (8) Parameter numerics area: displays parameter values, alarm limits, and alarm status. Selecting a parameter numeric block enters corresponding parameter dialog. For more information, see 3.11.4 Accessing Parameter Setup Dialogs.
- (9) Parameter waveform/numerics area: displays parameter waveforms or parameter values, alarm limits, and alarm status. Selecting a parameter waveform of numeric block enters corresponding parameter dialog. For more information, see 3.11.4 Accessing Parameter Setup Dialogs.
- (10) Parameter waveform area: displays parameter waveforms. Select a waveform enters corresponding parameter dialog. For more information, see 3.11.4 Accessing Parameter Setup Dialogs.

### 3.6.1 On-screen Symbols

The following table lists the on-screen symbols displayed on the system status information area:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Male]</td>
<td>Adult, male</td>
<td>![Female]</td>
<td>Adult, female</td>
</tr>
</tbody>
</table>
3.6.2 Dialogs

All dialogs have similar style and structure, see the figure below:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🧪</td>
<td>Pediatric, male</td>
<td>🧪</td>
<td>Pediatric, female</td>
</tr>
<tr>
<td>🧪♂️</td>
<td>Neonate, male</td>
<td>🧪♀️</td>
<td>Neonate, female</td>
</tr>
<tr>
<td>🌐</td>
<td>Wireless network is connected. The solid part indicates network signal strength.</td>
<td>🌐</td>
<td>Wireless network is not connected.</td>
</tr>
<tr>
<td>🌐</td>
<td>Wired network is connected.</td>
<td>🌐</td>
<td>Wired network is not connected.</td>
</tr>
<tr>
<td>🚫</td>
<td>All the alarms are paused.</td>
<td>✗</td>
<td>Individual physiological alarms are turned off or the monitor is in the alarm off status.</td>
</tr>
<tr>
<td>🚫</td>
<td>Audible alarm tones are paused.</td>
<td>✗</td>
<td>Audible alarm tones are turned off.</td>
</tr>
<tr>
<td>🚫</td>
<td>Alarms are acknowledged and the alarm system is reset.</td>
<td>🌋</td>
<td>The battery is working correctly. The green portion represents the remaining charge.</td>
</tr>
<tr>
<td>🌋</td>
<td>The battery has low power and needs to be charged.</td>
<td>🌋</td>
<td>The battery has critically low charge and needs to be charged immediately. Otherwise, the monitor will automatically shut down soon.</td>
</tr>
<tr>
<td>🌋</td>
<td>The battery is being charged.</td>
<td>✗</td>
<td>No battery is installed.</td>
</tr>
<tr>
<td>🌋⚠️</td>
<td>Battery fault, battery communication fault, or battery charging fault. Contact service personnel for help.</td>
<td>✗</td>
<td></td>
</tr>
</tbody>
</table>
3.6.3 Quick Keys of the N1

The monitor provides quick keys for you to quickly access some functions. The quick key area is located at the right of the screen. The quick key area displays 5 quick keys. You can also swipe down on the quick key area for more quick keys. The following table shows available quick keys.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Label</th>
<th>Function</th>
<th>Symbol</th>
<th>Label</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alarm Reset</td>
<td>Acknowledges the ongoing alarms.</td>
<td></td>
<td>Screen Setup</td>
<td>Enters the Screen Setup dialog.</td>
</tr>
<tr>
<td></td>
<td>Alarm Pause</td>
<td>Pauses the current alarms.</td>
<td></td>
<td>Print</td>
<td>Starts printing a real-time report.</td>
</tr>
<tr>
<td></td>
<td>Audio Pause</td>
<td>Pauses alarm tone.</td>
<td></td>
<td>Standby</td>
<td>Enters the Standby mode.</td>
</tr>
<tr>
<td></td>
<td>NIBP Start/</td>
<td>Starts an NIBP measurement or stops</td>
<td></td>
<td>Manual Event</td>
<td>Manually triggers and saves an event.</td>
</tr>
<tr>
<td></td>
<td>Stop</td>
<td>the current NIBP measurement.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lock</td>
<td>Selects and operates as instructed to unlock the touchscreen</td>
<td></td>
<td>NIBP Measure</td>
<td>Enters the NIBP Measure dialog.</td>
</tr>
<tr>
<td></td>
<td>Unlock</td>
<td>Selects and operates as instructed to lock the touchscreen</td>
<td></td>
<td>Main Menu</td>
<td>Enters the main menu.</td>
</tr>
</tbody>
</table>

3.7 Operating Modes

The monitor provides different operating modes. This section describes the monitoring mode and the standby mode.

3.7.1 Monitoring Mode

The monitoring mode is the most frequently used clinical mode for patient monitoring. When the monitor is turned on, it automatically enters the monitoring mode.
3.7.2 Module Mode

When the N1 is connected to the host monitor, the N1 enters the module mode. For connection of the N1 and the host monitor, see section 2.9 N1 in Use with a Host Monitor. The N1 monitor has the following features when it enters the module mode:

- The patient information, parameter setup, and alarm setup of the N1 and the host monitor will be synchronized. For data transfer strategy, see the operator's manual of the host monitor.
- The N1 can still store the parameter data and the alarm events.
- The N1 receives and stores the parameter trends data from the host monitor.
- All audible sounds of the N1 are off.
- Wired and wireless network of the N1 are not available.
- The alarm indications of the battery related alarms of the N1 are given by the host monitor.
- Turning on or off the host monitor simultaneously powers on or off the N1.
- The main screen of the N1 is off when it is connected to the host monitor through the SMR or the module rack of the host monitor.

The N1 resumes to monitor mode when it is disconnected from the host monitor.

3.7.3 Privacy Mode

The privacy mode is a special clinical monitoring mode. In the privacy mode, the monitor does not display patient information and monitoring data. This provides controlled access to patient data and ensures confidentiality.

The privacy mode is only available when the patient admitted by the monitor is also monitored by the CMS. The monitor continues monitoring the patient, but patient data is only visible at the CMS.

3.7.3.1 Entering the Privacy Mode

To enter the privacy mode, select the Main Menu quick key → from the Display column select Privacy Mode → select OK.

The monitor has the following features after entering the privacy mode:

- The screen turns blank.
- Except for the low battery alarm, the monitor inactivates alarm tone and alarm light of all other alarms.
- The monitor suppresses all system sounds, including heart beat tone, pulse tone, and prompt tone.

**WARNING**

- In Privacy mode, all audible alarms are suppressed and the alarm light is deactivated at the monitor. Alarms are presented only at the CMS. Pay attention to potential risk.

**NOTE**

- The privacy mode is not available if the Department is set to OR.
- You cannot enter the privacy mode if a low battery alarm occurs.

3.7.3.2 Exiting the Privacy Mode

The monitor automatically exit the privacy mode in any of the following situations:

- The monitor disconnects from the CMS.
- The low battery alarm occurs.

You can also operate the touchscreen, mouse, or keyboard to manually exit the privacy mode.
3.7.4 **Night Mode**
The night mode is a special clinical monitoring mode. To avoid disturbing the patient, you can use the night mode.

### 3.7.4.1 Entering the Night Mode
To enter the night mode, follow this procedure:
1. Select the **Main Menu** quick key → from the **Display** column select **Night Mode**.
2. Change the night mode settings if necessary.
3. Select **Enter Night Mode**.

The night mode settings are as follows by default:

- Brightness: 1
- Alarm Volume: 2
- QRS Volume: 1
- Key Volume: 0
- NIBP End Tone: Off
- Stop NIBP: Off

**CAUTION**
- Verify the night mode settings before entering the night mode. Pay attention to the potential risk if the setting value is low.

### 3.7.4.2 Exiting the Night Mode
To cancel the night mode, follow this procedure:
1. Select the **Main Menu** quick key → from the **Display** column select **Exit Night Mode**.
2. Select **OK**.

**NOTE**
- If your monitor is connected to the CMS, it automatically exits the night mode when being disconnected from the CMS.
- The monitor resumes the previous settings after exiting the night mode.

3.7.5 **Standby Mode**
You can temporarily stop patient monitoring without switching off the monitor by entering the standby mode.

### 3.7.5.1 Entering the Standby Mode
1. Select the **Standby** quick key, or select the **Main Menu** quick key → from the **Patient Management** column select **Standby**.
2. Define where the patient is by selecting a location in the drop down list when the monitor enters the standby mode.
3. Select **OK**.

The monitor behaves as follows after entering the standby mode:

- Stops all parameter measurements.
- Disables all the alarms and prompt messages, except for the battery low alarm.
- Turns screen brightness to the dimmest after entering the standby mode for 30 seconds.
WARNING

• Pay attention to the potential risk of placing the monitor to standby. In the standby mode, the monitor stops all parameter measurements and disable all the alarm indications, except for the battery low alarm.

3.7.5.2 Changing the Patient Location at Standby

If you need to change the patient’s location, select patient location from the standby screen.

3.7.5.3 Exiting the Standby Mode

To exit the standby mode, choose any of the following ways:

■ Select Resume Monitor to exit the standby mode and resume monitoring the current patient.
■ Select Discharge Patient to discharge the current patient.

3.7.6 Outdoor Mode

The outdoor mode is intended for transferring patients outdoors. The monitor behaves as follows after entering the outdoor mode:

■ The parameter color is white and unchangeable.
■ The screen brightness is automatically changed to 10.

3.7.6.1 Entering the Outdoor Mode

To enter the outdoor mode, select the Main quick key → from the Display column select Enter Outdoor Mode.

NOTE

• The monitor enters the outdoor mode automatically if the strength of ambient light is greater than the threshold.

3.7.6.2 Exiting the Outdoor Mode

When Enter Outdoor Mode is set to Manual, select the Main Menu quick key → from the Display column select Exit Outdoor Mode.

The monitor automatically exits the outdoor mode in the following situation:

■ The monitor is connected to a host monitor.
■ The strength of ambient light is lower than the threshold when Enter Outdoor Mode is set to Auto.

3.8 Configuring Your Monitor

Configure your monitor before putting it in use.

3.8.1 Setting the Date and Time

To set the system time, follow this procedure:

1. Select the Main Menu quick key → from the System column select Time.
2. Set Date and Time.
3. Set Date Format.
4. If you want to use the 12-hour mode, switch off 24 Hour Time.
5. If you want to use daylight saving time, switch on Daylight Saving Time. You can manually switch on or off the daylight saving time only when the auto daylight saving time function is disabled. For more information, see 21.7 Enabling Auto Daylight Savings Time for details.
If your monitor is connected to a central monitoring system (CMS) or hospital clinical system (HIS), the date and time are automatically taken from the CMS. In this case, you cannot change the date and time from your monitor.

**CAUTION**

- Changing the date and time affects the storage of trends and events and may result in loss of data.

### 3.8.2 Adjusting the Screen Brightness

To adjust the screen brightness, follow this procedure:

1. Access **Display** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Display** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Display**.
2. Set the **Brightness**. If **Brightness** is set to **Auto**, the monitor automatically adjust the screen brightness according to the ambient light.

### 3.8.3 Adjusting the Key Volume

To adjust the key volume, follow this procedure:

1. Select the **Main Menu** quick key → from the **Display** column select **Display**.
2. Set the **Key Volume**.

### 3.9 Starting Monitoring a Patient

After turning on your monitor, follow this procedure to monitor a patient:

1. Admit the patient.
2. Check patient settings. Make sure that alarm limits, patient category and paced status, and so on, are appropriate for your patient. Change them if necessary.
3. Perform desired measurements. For more information, see corresponding measurement chapters.

### 3.10 Stopping a Parameter Measurement

To stop monitoring a parameter, follow this procedure:

1. Remove corresponding sensor from the patient.
2. Disconnect the sensor from the patient cable.
3. Disconnect the patient cable from the parameter connector.
4. If you are using the disposable sensor, discard it.

### 3.11 General Operation

This section describes the operations that are generally used when monitoring a patient.

#### 3.11.1 Switching On or Off a Parameter

You can manually switch on or off a parameter when its module is connected. To do so, follow this procedure:

1. Access **Parameters On/Off** by any of the following ways:
   - Select the **Screen Setup** quick key → select the **Parameters On/Off** tab.
   - Select the **Main Menu** quick key → from the **Parameters** column select **Parameters On/Off**.
2. Switch on or off desired parameters.

When a parameter is switched off, the monitor stops data acquisition and alarming for this measurement.
3.11.2 Displaying Parameter Numerics and Waveforms

You can configure the parameter numerics, waveforms, and their sequence displayed on the normal screen. To do so, follow this procedure:

1. Access **Tile Layout** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Tile Layout**.

2. Select a parameter numeric area or waveform area, and then from the popup list select an element you want to display in this area. The parameters and waveforms you did not select will not be displayed.

**NOTE**

• ECG parameters and waveform are always displayed on the first line of the parameter numeric area and waveform area.

3.11.3 Displaying the Parameter List

You can display trends of HR, SpO₂, RR, and NIBP/IBP in the parameter numerics area. To do so, follow this procedure:

1. Access **Tile Layout** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Tile Layout**.

2. Select the parameter numerics area where you want to display the parameter list, and then from the popup list select **Parameter List**.

3.11.4 Accessing Parameter Setup Dialogs

Each parameter has a setup dialog in which you can adjust the alarm and parameter settings. You can enter a parameter setup dialog by using any of the following methods:

■ Select the parameter numeric area or waveform area.
■ Press the setup hard key on the module front of the CO₂ module.
■ Select the **Parameter Setup** quick key, and then select the desired parameter.
■ Select the **Main Menu** quick key → from the **Parameters** column select **Setup** → select the desired parameter.

**NOTE**

• In this manual, we always use the first method to enter the setup dialog. But you can use any method you prefer.

3.11.5 Choosing a Screen

The monitor enters the normal screen after it is powered on. The normal screen is most frequently used for patient monitoring. You can also select other screens. To do so, follow this procedure:

1. Access **Choose screen** in either of the following ways:
   - Select the **Screen Setup** quick key.
   - Select the **Main Menu** quick key → from the **Display** column select **Choose screen**.

2. Select the desired screen.
3.11.6 Selecting the Big Numerics Screen

The big numerics screen displays parameter numerics in big font size. You can configure the parameters and their layout on the big numeric screen. Quickly switch between the normal screen and the big numeric screen by swiping left or right on the touchscreen with two fingers. You can also select the big numeric screen by proceeding as follows:

1. Access **Choose screen** in either of the following ways:
   - Select the **Screen Setup** quick key.
   - Select the **Main Menu** quick key → from the **Display** column select **Choose screen**.
2. Select **Big Numerics**.
3. Select **Big Numerics** tab.
4. Select a parameter numeric area or waveform area, and then from the popup list select an element to display in this area.

3.11.7 Changing Measurement Colors

You can set the color of measurement values and waveforms for each parameter. To do so, follow this procedure:

1. Select **Main Menu** quick key → from the **Parameters** column select **Parameter Color**.
2. Select the **Current** tab and set the colors of the currently monitoring measurement values and waveforms.
3. Select the **All** tab and set the colors of measurement values and waveforms for all parameters.

3.12 Disconnecting the Wireless Network

To disconnect the wireless network manually, follow this procedure:

1. Swipe the screen from top down with a single finger.
2. Select .

To reconnect the wireless network after it is disconnected manually, follow this procedure:

1. Swipe the screen from top down with a single finger.
2. Select .

3.13 Turning Off the Monitor

Before turning off the monitor, perform the following check:

1. Ensure that monitoring of the patient has been completed.
2. Disconnect the cables and sensors from the patient.
3. Save or clear the patient data as required.

To turn off the monitor, press and hold the power switch for 3 seconds.

**CAUTION**

- Press and hold the power switch for no less than 10 seconds to forcibly shut down the monitor if it could not be shut down normally. This may cause loss of patient data.

**NOTE**

- Turning off the monitor does not disconnect the monitor form the AC mains. To completely disconnect the power supply, unplug the power cord.
- In case of a temporary power failure, if the power is restored within 30 minutes, monitoring will resume with all active settings unchanged. If the monitor is without power for more than 30 minutes, it behaves the same as if it were normally turned off.
4 Using the External Display

4.1 Using the External Display

The N1 can be connected to an external display through the VGA connector of the Dock. When the external display is connected, you can monitor a patient’s condition either through the N1 or through the external display.

The external display can be configured as independent display enabling it to be configured to show different information than the N1. For the configuration of the independent external display, see section 21.15.4 Setting the External Display.

The following screens or functions can be viewed and operated only on the independent external display:

- Minitrends Screen
- OxyCRG Screen
- Remote View Screen
- ECG Half-Screen
- PAWP Screen
- Calculations
- EWS
- GCS
- ST Graphic
- SpO₂ Screen

**NOTE**

- The external display can share the mouse or keyboard with the monitor. If the mouse or keyboard are needed, connect them to the USB connector of the Dock.

4.1.1 Connecting the N1 to the External Display

To connect the external display, follow this procedure:

1. Connect the Dock and the external display using the VGA cable.
2. Connect the Dock and the external display using the USB cable accompanying the external display.
3. Connect the external display to the AC mains and turn on the display.
4. Connect the N1 to the Dock.

4.1.2 External Display Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image offset</td>
<td>Adjust the external display by using the auto adjust function or adjust the external display manually.</td>
</tr>
</tbody>
</table>
| No image or the image displays abnormally | - Check that the external display is properly connected to the AC mains and is powered on.  
  - Check that the VGA cable is properly connected. 
  - Remove the N1 from the Dock and reconnect it. |
| Touchscreen failure            | Check that both ends of the USB cable accompanying the external display are connected properly to the Dock and the external display. |
4.1.3 Quick keys of the independent external display

The following table displays the quick keys that are available for the independent external display.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Label</th>
<th>Function</th>
<th>Symbol</th>
<th>Label</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Symbol" /></td>
<td>Alarm Reset</td>
<td>Acknowledges the ongoing alarms.</td>
<td><img src="image2" alt="Symbol" /></td>
<td>Screen Setup</td>
<td>Enters the Screen Setup dialog.</td>
</tr>
<tr>
<td><img src="image3" alt="Symbol" /></td>
<td>Alarm Pause</td>
<td>Pauses the current alarms.</td>
<td><img src="image4" alt="Symbol" /></td>
<td>Print</td>
<td>Starts printing a real-time report.</td>
</tr>
<tr>
<td><img src="image5" alt="Symbol" /></td>
<td>Audio Pause</td>
<td>Pauses alarm tone.</td>
<td><img src="image6" alt="Symbol" /></td>
<td>Standby</td>
<td>Enters the Standby mode.</td>
</tr>
<tr>
<td><img src="image7" alt="Symbol" /></td>
<td>NIBP Start/Stop</td>
<td>Starts an NIBP measurement or stops the current NIBP measurement.</td>
<td><img src="image8" alt="Symbol" /></td>
<td>Manual Event</td>
<td>Manually triggers and saves an event.</td>
</tr>
<tr>
<td><img src="image9" alt="Symbol" /></td>
<td>NIBP Measure</td>
<td>Enters the NIBP Measure dialog.</td>
<td><img src="image10" alt="Symbol" /></td>
<td>Main menu</td>
<td>Enters the main menu.</td>
</tr>
<tr>
<td><img src="image11" alt="Symbol" /></td>
<td>Alarm Setup</td>
<td>Enters the Alarm dialog.</td>
<td><img src="image12" alt="Symbol" /></td>
<td>More</td>
<td>Shows more quick keys.</td>
</tr>
<tr>
<td><img src="image13" alt="Symbol" /></td>
<td>Discharge Patient</td>
<td>Enters the Discharge Patient dialog box.</td>
<td><img src="image14" alt="Symbol" /></td>
<td>Parameters Setup</td>
<td>Enters the Parameters Setup dialog.</td>
</tr>
<tr>
<td><img src="image15" alt="Symbol" /></td>
<td>Review</td>
<td>Enters the Review dialog.</td>
<td><img src="image16" alt="Symbol" /></td>
<td>Patient Management</td>
<td>Enters the Patient Management dialog.</td>
</tr>
<tr>
<td><img src="image17" alt="Symbol" /></td>
<td>NIBP STAT</td>
<td>Starts a five-minutes continuous NIBP measurement.</td>
<td><img src="image18" alt="Symbol" /></td>
<td>Stop All</td>
<td>Stops all NIBP measurements.</td>
</tr>
<tr>
<td><img src="image19" alt="Symbol" /></td>
<td>Zero IBP</td>
<td>Starts IBP zero calibration.</td>
<td><img src="image20" alt="Symbol" /></td>
<td>PAWP</td>
<td>Enters the PAWP screen.</td>
</tr>
<tr>
<td><img src="image21" alt="Symbol" /></td>
<td>Venipuncture</td>
<td>Opens the Venipuncture dialog.</td>
<td><img src="image22" alt="Symbol" /></td>
<td>ECG Lead/Gain</td>
<td>Enters the ECG Lead/Gain dialog.</td>
</tr>
<tr>
<td><img src="image23" alt="Symbol" /></td>
<td>Remote View</td>
<td>Opens the Remote View screen.</td>
<td><img src="image24" alt="Symbol" /></td>
<td>Minitrends</td>
<td>Enters the Minitrends screen.</td>
</tr>
<tr>
<td><img src="image25" alt="Symbol" /></td>
<td>OxyCRG</td>
<td>Opens the OxyCRG screen.</td>
<td><img src="image26" alt="Symbol" /></td>
<td>ECG Full-Screen</td>
<td>Enters the 12-lead ECG full screen.</td>
</tr>
</tbody>
</table>
4.1.4 Configuring the Displayed Quick Keys (only available when the N1 is used with the independent external display)

To select the quick keys you want to display, follow this procedure:

1. Access Quick Key in either of the following ways:
   - Select the Screen Setup quick key → Select the Quick Keys tab.
   - Select the Main Menu quick key → from the Display column select Quick Keys.

2. Select the Current tab to configure the quick keys you want to display on the screen: From the top of this page, select a block where you want to show a certain quick key, and then select the quick key from the quick key list. For example, if you want to show the Screen Setup quick key at the first block, select the first block, and then select Screen Setup from the list.

3. Select the More tab to configure the quick keys you want to display when the More quick key is selected.

4.2 Minitrends Screen

The Minitrends screen shows the recent graphic trends of parameters.

4.2.1 Entering the Minitrends Screen

Choose one of the following methods to enter the Minitrends screen:

- Swipe left or right on the touchscreen with two fingers to switch among the Minitrends screen, normal screen, and the big numerics screen.
- Select the Minitrends quick key.
- Select the Screen Setup quick key → Select the Choose Screen tab → select Minitrends.
- Select the Main Menu quick key → from the Display column select Choose Screen → select Minitrends.
4.2.2 The Display of Minitrends Screen

The following figure shows the minitrends screen. Your display may be configured to look slightly different.

(1) Scale
(2) **Routine Vital** button. If the department is set to **OR**, then **Baseline** button is displayed.
(3) Routine Vital/Baseline
(4) Time line
(5) Alarm statistic area

4.2.3 Setting Minitrends Parameters

To set parameters, follow this procedure:
1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Set parameters. If you want to use the default parameters, select **Default Parameter**.

4.2.4 Setting the Minitrend Length

To set the Minitrend length, follow this procedure:
1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Set the **Minitrend Length**.

4.2.5 Setting the Alarm Statistics Switch

The Minitrends screen can be configured to display the statistic number of physiological alarm in its lower half screen. To set the alarm statistics switch, follow this procedure:
1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Switch on or off the **Alarm Statistics** switch.

### 4.2.6 Setting the Alarm Statistics Duration

The time length within which the alarms statistics are made is configurable. To set the alarm statistics length, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Set **Alarm Statistics Duration**.

### 4.2.7 Routine Vital/Baseline

The Routine vital/Baseline function is used for marking the parameter measurements of certain moment for later reference. If the department is set to **OR**, then the Baseline button is available. For other departments, the **Routine Vital** button is available.

#### 4.2.7.1 Manually Marking the Routine Vital/Baseline

To manually mark the Routine Vital/Baseline, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Routine Vital** button or **Baseline** button.

**NOTE**

- If you do not see the Baseline button or Routine Vital button in the Minitrends screen, you can select the Setup button and switch on the Baseline switch, or set the Routine Vital to Manual or Auto.

#### 4.2.7.2 Configuring Automatic Routine Vital Settings

The monitor can automatically mark the routine vital sign values. To enable this function, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Select **Auto** from the dropdown list of **Routine Vital**.
4. Select **Time** to set the time for marking the first routine vital sign values.
5. Select **Interval** to set the interval for marking the routine vital sign values.

### 4.3 The OxyCRG Screen

The OxyCRG screen is the default user screen when the Neonatology department is selected. It displays 6-minute HR, SpO\textsubscript{2} trends, CO\textsubscript{2}/Resp compressed waveform, ABD parameters, and the latest ABD events. The OxyCRG function is intended for neonatal patients only.

#### 4.3.1 Entering the OxyCRG Screen

To enter the OxyCRG screen, choose any of the following ways:

- Swipe left or right on the touchscreen with two fingers to switch to the OxyCRG screen.
- Select the **OxyCRG** quick key.
- Select the **Screen Setup** quick key → select the **Choose Screen** tab → select **OxyCRG**.
- Select the **Main Menu** quick key → from the **Display** column select **Choose Screen** → select **OxyCRG**.

#### 4.3.2 The Display of the OxyCRG Screen

The following figure shows the OxyCRG screen. Your display may be configured to look slightly different.
4.3.3 OxyCRG Events

The following table lists the ABD events and their criteria:

<table>
<thead>
<tr>
<th>Event type</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| A          | Zero RR event: the zero RR duration exceeds the threshold.  
  • A20: the zero RR duration is greater or equal to 20 seconds.  
  • A15: the zero RR duration is between 15 to 20 seconds (excluding 20 seconds).  
  • A10: the zero RR duration is between 10 to 15 seconds (excluding 15 seconds). | A20 is a red event |
| B          | Bradycardia event: the duration of low heart rate, extreme bradycardia, or asystole exceeds the threshold. | / |
| D          | Low SpO2 event: the SpO2 value is lower than the SpO2 Desat limit. | / |
| BD         | Bradycardia and low SpO2 happen at the same time. | / |
| AB         | Zero RR and bradycardia happens at the same time. | Red event |
| AD         | Bradycardia and low SpO2 happen at the same time. | Red event |
| ABD        | Zero RR, bradycardia, and low SpO2 happen at the same time. | Red event |

**NOTE**

- The monitor records all ABD events for OxyCRG review, but only red events displays in the ABD list of the OxyCRG screen.

4.3.4 The Display of the ABD Event Area

The ABD event area displays parameter values of currently active OxyCRG events and lists the latest red ABD events.
4.3.5 Setting OxyCRG Parameters
Select parameter trends or compressed waveform to set parameters and the compressed waveform you want to display. The selected parameters will be used for ABD event calculation.

4.3.6 Setting the Threshold of ABD Events
Select any parameter trend or the compressed waveform to perform the following setup:
- Set the threshold of ABD events.
- Set Event Storage Format:
  - 1 min+3 min: stores data one minute before and three minutes after the event.
  - 3 min+1 min: stores data three minutes before and one minute after the event.
  - 2 min+2 min: stores data two minutes before and two minutes after the event.

The stored data includes the trends of the OxyCRG parameters, compressed waveform, alarm thresholds, NIBP, and Temp measurements.

4.3.7 Editing ABD Events
To edit ABD events, follow this procedure:
1. Select the Mark button to enter the Mark dialog box.
2. Drag the event list upwards and downwards to select the desired event.
3. Select the patient's status when the event happened.
4. Select Save.

4.4 The SpO2 Screen
For neonatal patients, if you are only concerned with the patient’s SpO2, you can use the SpO2 screen. The SpO2 screen displays SpO2 related data. It also displays realtime Temp and NIBP measurements.

**NOTE**
- The SpO2 screen is intended for neonatal patient only.

4.4.1 Entering the SpO2 Screen
To enter the SpO2 screen, choose any of the following ways:
- Swipe left or right on the touchscreen with two fingers to switch to the SpO2 screen.
- Select the Screen Setup quick key → select the Choose Screen tab → select SpO2 Screen.
- Select the Main Menu quick key → from the Display column select Choose Screen → select SpO2 Screen.

4.4.2 The Display of SpO2 Screen
The following figure shows the SpO2 screen. Your display may be configured to look slightly different.

1. Tabular trend: displays trends of SpO2, PR, and PI.
2. SpO2 statistics area: displays the statistics data of each SpO2 section.
3. Temp area: displays Temp measurements and alarm limits.
4. NIBP area: displays NIBP measurements and alarm limits.
5. SpO2 area: displays measurements and alarm limits of SpO2, PR, and PI. The dashboards show information of alarm limits. The △ pointers indicate the current measurement values.
4.4.3 Operating the SpO₂ Screen

You can access parameter setup and trends review from the SpO₂ screen. To do so, follow this procedure:

- Select the trend of SpO₂, PR, or PI to enter the Tabular Trends review page.
- Select the SpO₂ statistics area to enter the SpO₂ Statistics setup menu. Set the range of each SpO₂ section and the target section.
- Select the value of SpO₂, PR, or PI, the dashboard, or Pleth waveform to enter the SpO₂ menu.
- Select the Temp area to enter the Temp menu.
- Select the NIBP area to enter the NIBP menu.

4.5 Remote View

The patient alarm and real time physiological data of the N1 can be viewed by other networked monitors. When the external display is connected, you can also observe alarm conditions and view real time physiological data from patients on other networked monitoring devices.

A device from a remote site is called a remote device or bed. You can simultaneously watch up to 12 remote devices. You can also view waveforms of one remote device on the external display.

You can watch the remote devices in the Remote View screen, or the alarm watch tiles on the main screen.

In the Remote View screen, you can view real time parameters and waveforms from one specific device, and watch the alarms of other monitored devices at the same time.

**NOTE**

- A particular monitor (e.g. Monitor #1) can be viewed by at most 32 remote devices at the same time, of which eight of those remote devices can watch Monitor #1’s waveforms.

4.5.1 Entering the Remote View Screen

To enter the Remote View screen, choose one of the following ways:

- Select the Remote View quick key.
- Select the bed at the alarm watch tile on the main screen. For more information, see 4.5.10.2 Displaying the Alarm Watch Tile on the Main Screen.
- Select the Screen Setup quick key → select the Choose Screen tab → select Remote View.

4.5.2 About the Remote View

The following figure shows the Remote View screen.
**WARNING**

- The data presented in the Remote View screen has a delay. Do not rely on this screen for real time data.
4.5.3 Adding a Bed

After adding the desired remote devices, then the alarms from these devices can be viewed on the monitor. To add a remote device, follow this procedure:

1. Enter the Select Bed dialog. To do so, choose either of the following ways:
   - In the Remote View screen, select Select Bed. For more information, see 4.5.1 Entering the Remote View Screen.
   - Select the icon at the alarm watch tile if the tile is configured to display on the main screen.
2. In the Select Bed dialog, select a desired department. All the beds under this department will be listed.
3. Select a desired tile at the A-W1, A-W2 or A-W3 areas and then select a bed from the bed list. The selected bed will appear in the tile.

**NOTE**

- The added bed is indicated by a check mark (√) at the right of the bed list.

4.5.4 Removing a Bed

To remove a remote device from remote monitoring, follow this procedure:

1. Enter the Select Bed dialog. Choose either of the following ways:
   - In the Remote View screen, select Select Bed. For more information, see 4.5.1 Entering the Remote View Screen.
   - Select the icon in the alarm watch tile if the tile is configured to display on the main screen.
2. In the Select Bed dialog, select a bed at the A-W1 or A-W2 area, and then select Clear Bed. If you want to remove all beds, select Clear All Beds.

4.5.5 Displaying the Main Bed

In the Remote View screen, you can select a bed in the alarm watch area, then the main body of the Remote View screen will display the real time monitoring screen of the device.

4.5.6 Saving a Manual Event

You can initiate a manual event on the remote monitor by selecting Manual Event in the Remote View screen.

4.5.7 Managing Alarms from Remote Devices

You can view and manage the alarms coming from remote devices.

If the monitor and remote devices have alarms at the same time, the monitor presents alarms according to the following rules:

- If the alarm tone pattern for the monitor is the same as that for the remote devices, the monitor prioritizes all the alarms and sounds the highest alarm tone.
- If the alarm tone pattern for the monitor is different from that for the remote devices, the monitor sounds the alarms in their corresponding tone.

The monitor provides the same alarm tone pattern for the remote device alarms as those for the monitor alarms by default. You can change the alarm tone pattern of the remote monitor; see 21.3.5.5 Setting the Tone Pattern for Alarms from Remote Devices.

4.5.8 Resetting Alarms for Remote Devices

You can reset the alarms on the remote devices by selecting Alarm Reset in the Remote View screen. This function needs to be enabled. For more information, see 21.3.5.1 Resetting Alarms for Remote Devices.

4.5.9 Selecting Beds By Care Group

If configured, the monitor automatically selects beds in the same care group during the shift of care groups in the CMS. To enable this function, follow this procedure:
1. Enter the **Select Bed** window. Choose either of the following ways:
   - In the **Remote View** window, select **Select Bed**. For more information, see 4.5.1 Entering the Remote View Screen for entering the **Remote View** window.
   - Select the  icon in the alarm watch tile if the tile is configured to display on the main screen.
2. In lower left corner of the **Select Bed** window, select **Select Beds By Care Group**.

### 4.5.10 Alarm Watch

The alarm watch function provides the alarm notification by color and sound.

- The monitor sounds the highest priority alarm tone from all the monitored remote devices.
- The monitor displays the highest priority alarm in corresponding background color for each bed at the following areas:
  - At the top of the **Remote View**. For more information, see 4.5.2 About the Remote View for details.
  - On the main screen. For more information, see 4.5.10.1 About Alarm Watch Tile for details.

#### 4.5.10.1 About Alarm Watch Tile

The main screen can display up to two alarm watch tiles, namely A-W1 and A-W2. Each tile can accommodate up to six beds.

The following figure shows the alarm watch tiles.

![Alarm Watch Tiles](image)

(1) Alarm watch tile label  
(2) Disconnection icon: when the remote device is disconnected, this icon displays at the tile, and the tile background color is red.  
(3) Select bed icon: select it to enter the **Select Bed** dialog.  
(4) More than one bed tile: when more than one bed is assigned to a tile, the tile displays the alarm status, connection status, etc.  
(5) One bed tile: when only one bed is assigned to a tile, the tile displays the parameter value and alarm message from this bed, etc.

The alarm watch tile is similar to alarm watch area in the **Remote View**. For more information, see 4.5.2 About the Remote View.

#### 4.5.10.2 Displaying the Alarm Watch Tile on the Main Screen

To configure the alarm watch tile to be displayed on the monitor’s main screen, follow this procedure:

1. Select the **Main Menu** quick key → from the **Display** column select **Choose Screen** to enter the **Screen Setup** dialog.
2. Select the **Tile Layout** tab.
3. Select the numeric area where you want to display the alarm watch tile, and then in the drop-down list, select **Alarm Watch** → A-W1 or A-W2.
4.6 Freezing Waveforms

During patient monitoring, the freeze feature allows you to freeze the currently displayed waveforms on the screen so that you can have a close examination of the patient’s status. Additionally, you can select any frozen waveform for recording.

4.6.1 Freezing Waveforms

To freeze waveforms, select the **Freeze** quick key. Except waveforms of the following screens, all displayed waveforms stop refreshing and scrolling after you select the **Freeze** quick key:

- Minitrends screen
- oxyCRG screen
- Remote View screen
- EWS screen

4.6.2 Viewing Frozen Waveforms

To view the frozen waveforms, follow this procedure:

- Select the **</>** button in the **Freeze** dialog.
- Slide the frozen waveform leftward or rightward.

At the lower right corner of the bottom most waveform displays the freeze time. The initial frozen time is **0 s**. With the waveforms scrolling, the freeze time changes at an interval of 1 second. For example, **-2 s** means the two seconds before the frozen time. This change will be applied for all waveforms on the screen.

**NOTE**

- You can view the frozen waveforms of up to 120 seconds.

4.6.3 Unfreezing Waveforms

To unfreeze the frozen waveforms, select the **X** button upper right corner of the **Freeze** dialog.

4.6.4 Printing Frozen Waveforms

To print the frozen waveforms, select the **Print** button at the upper left corner of the **Freeze** dialog.
5 Managing Patients

5.1 Starting Monitoring a Patient
After turning on the monitor, follow this procedure to monitor a patient:
1. Admit the patient.
2. Check patient settings. Make sure that alarm limits, patient category and paced status, and so on, are appropriate for the patient. Change them if necessary.
3. Perform desired measurements. For more information, see corresponding measurement chapters.

5.2 Admitting a Patient
The monitor admits a new patient in the following situations:
- After a patient is manually discharged, the monitor automatically admits a new patient.
- After being switched off for the selected time period, the monitor automatically discharges the previous patient and admits a new patient at startup.
- If the monitor has not detected certain patient vital signs (ECG, SpO₂, PR, RR, NIBP) for 30 minutes, it will prompt whether to start monitoring a new patient if any of the above vital signs are detected again.

Always input patient information as soon as the patient is admitted. For more information, see 5.2.2 Editing Patient Information for details.

WARNING
- The default Patient Category setting is Adult, and Paced setting is Unspecified. Set Paced and check if the Patient Category setting is correct for the patient.
- For paced patients, set Paced to Yes. If it is incorrectly set to No, the monitor could mistake a pace pulse for a QRS and fail to alarm when the ECG signal is too weak.
- For non-paced patients, set Paced to No.

5.2.1 Entering the Patient Management Dialog
Use any of the following methods to enter the Patient Management dialog:
- Select the patient information area at the top left corner of the screen.
- Select the Patient Management quick key (only available when the N1 is used with the independent external display).
- Select the Main Menu quick key → from the Patient Management column select Patient Management.

5.2.2 Editing Patient Information
Edit patient information after a patient has been admitted, or when patient information is incomplete, or when it is necessary to change patient information:

To edit patient information, follow this procedure:
1. Enter the Patient Management dialog. For more information, see 5.2.1 Entering the Patient Management Dialog.
2. Edit patient information as required.

If a barcode reader is connected to the monitor, scanning the patient’s barcode will enter the patient’s information.
NOTE

• The monitor will reload the configuration if you changed the patient category.

5.2.3 Loading Patient Information from the CMS

If the monitor is connected to the central monitoring system (CMS). You can load patient information from the CMS to the monitor. To do so, follow this procedure:

1. Enter the Find Patient dialog in either of the following ways:
   ◆ Select the Main Menu quick key → from the Patient Management column select Find Patient.
   ◆ From the Patient Management dialog select Find Patient.
2. Input query criteria.
3. Select Search. Then a list pops up, including all the patients that meet the query criteria.
4. Select a patient from the patient list, and then select Admit. Corresponding patient information in the monitor will be updated.

NOTE

• If ADT Query is switched on, input query criteria from the Discharged Patient page.

5.2.4 Loading Patient Information from the ADT Server

If the monitor is connected with the Admit-Discharge-Transfer (ADT) server through the eGateway. You can load patient information from ADT server to the monitor.

To do so, follow this procedure:

1. Enter the Find Patient dialog in either of the following ways:
   ◆ Select the Main Menu quick key → from the Patient Management column select Find Patient.
   ◆ Select Find Patient from the Patient Management dialog.
2. Input query criteria.
3. Select Search. Then a list pops up, including all the patients that meet the query criteria.
4. Select a patient from the patient list, and then select Admit. Corresponding patient information in the monitor will be updated.

NOTE

• You can load patient information from the ADT server only when ADT Query is enabled. For more information, see 21.11.7 Using the ADT Gateway.
• The monitor can automatically upload the patient information from the ADT server when:
  ◆ The configured keywords of the monitor and the eGateway are the same.
  ◆ The IP address of the monitor is added to the eGateway configuration dialog.
• Loading patient information from the ADT server updates only patient information in the monitor. The patient's monitoring data is not changed and the patient is not discharged.

5.3 Transferring Patient

Patient settings and data can be transferred from an N1 into a host monitor. The patient settings and data includes patient information, trend data, alarm events, and parameter alarm limits. The N1 also allows transfer of full disclosure data.

For detailed information about patient data transfer, refer to the user manual of the host monitor. For the connection of N1 and the host monitor, refer to section 2.9 N1 in Use with a Host Monitor.
5.4 Exporting Patient Data

To export the data of the current patient and discharged patients, follow this procedure:

1. Connect the N1 to the Dock.
2. Connect the USB drive to the Dock's USB connector.
3. Access the Discharged Patients dialog box by selecting the Main Menu quick key → from the Patient Management column select Discharged Patients.
4. From the patient list select desired patients.
5. Select Export Data.

5.5 Deleting Patient Data

To delete the data of discharged patients, follow this procedure:

1. Access the Discharged Patients dialog box by selecting the Main Menu quick key → from the Patient Management column select Discharged Patients.
2. From the patient list select desired patients.
3. Select Delete.

5.6 Stopping a Parameter Measurement

To stop monitoring a parameter, follow this procedure:

1. Remove corresponding sensor from the patient.
2. Disconnect the sensor from the patient cable.
3. Disconnect the patient cable from the parameter module.

5.7 Discharging a Patient

Before monitoring a new patient, discharge the previous patient. The technical alarms are reset, and monitor settings return to their defaults. For more information, see 20.4 Setting Default Configuration.

After a patient is discharged, the monitor automatically admits a new patient.

WARNING

• Always discharge the previous patient before starting to monitor a new patient. Failure to do so can lead to data being associated with the wrong patient.
- Select the **Patient Management** quick key → **Discharge Patient** (only available when the N1 is used with the independent external display).

- Select the **Main Menu** quick key → from the **Patient Management** column select **Discharge**.

Select a button in the **Discharge Patient** dialog:

- **Print End Case Report**: prints the end case report when the patient is discharged.

- **Discharge**: clears the waveform data of the current patient. The monitor loads the default configuration and goes to the standby mode. The current patient becomes a discharged patient.

- **Clear Patient Data**: discharges the current patient and clears the waveform data. The monitor still uses the current configuration and does not go to the standby mode. The current patient becomes a discharged patient.
6 Alarms

6.1 Alarm Introduction
This chapter describes alarm functions and alarm settings.

6.2 Alarm Safety Information

**WARNING**

- A potential hazard can exist if different alarm presets and default configuration settings are used for the same or similar equipment in the same care area, for example an intensive care unit or cardiac operating room.
- If the monitor is connected to the central monitoring system (CMS) or other monitors, alarms can be presented and controlled remotely. Remote suspension, inhibition, or reset of monitor alarms via the CMS or other monitors may cause a potential hazard. For more information, see the operator’s manuals for the CMS and the other monitors.
- The monitors in the care area may each have different alarm settings to suit different patients. Always check that the alarm settings are appropriate for the patient before starting the monitoring. Always make sure that necessary alarm limits are active and set according to the patient’s clinical condition.
- Setting alarm limits to extreme values may cause the alarm system to become ineffective. For example, setting the SpO₂ high alarm limit to 100%, is equivalent to switching the alarm off.
- When the alarm sound is switched off, the monitor gives no alarm tones even if a new alarm occurs. Be careful when considering to switch off the alarm sound. When the alarms are off or while alarm audio is paused either temporarily or indefinitely, observe the patient frequently.
- When monitoring patients that are not continuously attended by a clinical operator, properly configure the alarm system and adjust alarm settings as per the patient’s condition.
- Do not rely exclusively on the audible alarm system for monitoring. Adjustment of alarm volume to a low level may result in a hazard to the patient.

6.3 Understanding the Alarms

6.3.1 Alarm Categories
The monitor has two different types of alarms: physiological alarms and technical alarms.

- Physiological alarms are triggered by patient measurement exceeding the parameter limits, or by an abnormal patient conditions.
- Technical alarms are triggered by an electrical, mechanical, connectivity, or other monitor abnormal operation, or by failure of a sensor or component. Technical alarm conditions may also be caused when an algorithm cannot classify or interpret the available data.

Apart from the physiological and technical alarms, the monitor can also prompt with some messages describing the system status or patient status.
6.3.2 Alarm Priorities

By severity, the alarms are classified into the following priority levels:

- **High priority alarms**: indicates a life threatening situation or a severe device malfunction. High priority alarms require an immediate response.
- **Medium priority alarms**: indicates abnormal vital signs or a device malfunction. Medium priority alarms require a timely response.
- **Low priority alarms**: indicate a discomfort condition, a device malfunction, or an improper operation. Low priority alarms require you to be aware of this condition.
- **Messages**: provides additional information on the patient or the equipment.

6.3.3 Alarm Indicators

When an alarm occurs, the monitor indicates it through visual or audible alarm indications. For more information, see the following table.

<table>
<thead>
<tr>
<th>Alarm Indicator</th>
<th>High Priority Alarm</th>
<th>Medium Priority Alarm</th>
<th>Low Priority Alarm</th>
<th>Message</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm lamp</td>
<td>Red</td>
<td>Yellow</td>
<td>Cyan</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Alarm lamp</strong></td>
<td><strong>Flash</strong></td>
<td><strong>Flashing</strong></td>
<td><strong>No flashing</strong></td>
<td><strong>Duty cycle:</strong></td>
<td><strong>100% on</strong></td>
</tr>
<tr>
<td><strong>frequency:</strong></td>
<td><strong>1.4 - 2.8 Hz</strong></td>
<td><strong>0.4 - 0.8 Hz</strong></td>
<td></td>
<td><strong>Duty cycle:</strong></td>
<td><strong>20 - 60% on</strong></td>
</tr>
</tbody>
</table>

**Audible tone pattern**: ISO

- Repeat pattern of triple + double + triple + double beeps
- Repeat pattern of triple beeps
- Repeat pattern of double beeps
- Repeat pattern of single beep
- Repeat pattern of high-pitched single beep
- Repeat pattern of double beeps
- Repeat pattern of high-pitched triple beeps

**Alarm message**: White text inside a red box

- Black text inside a yellow box
- Black text inside a cyan box
- White text

**Alarm priority indicator**: ***

- ****
- *

**Parameter value**: White text inside a flashing red box

- Black text inside a flashing yellow box
- Black text inside a flashing cyan box

**NOTE**

- When multiple alarms of different priority levels occur simultaneously, the monitor selects the highest priority alarm to light the alarm lamp and issue the alarm tone.
- When multiple alarms of different priority levels occur simultaneously and should be displayed in the same area, the monitor only displays the messages from the highest priority alarm.
- When multiple alarms of the same priority levels occur simultaneously and should be displayed in the same area, all the alarm messages are displayed cyclically.
- Some physiological alarms, such as Asystole, are exclusive. They have identical alarm tones and alarm lights with normal high level physiological alarms, but their alarm messages are displayed.
exclusively. That is, when an exclusive physiological alarm and a normal high level physiological alarm are triggered simultaneously, only exclusive physiological alarm message will be displayed.

6.3.4 Alarm Status Symbols

Apart from the alarm indicators as described in 6.3.3 Alarm Indicators, the monitor uses the following symbols to indicate the alarm status:

- Alarm pause: indicates that all the alarms are paused.
- Alarm off: indicates that individual measurement alarms are turned off or the system is in the alarm off status.
- Audio pause: indicates that audible alarm tones are paused.
- Audio off: indicates that audible alarm tones are turned off.
- Alarm reset: indicates that alarms are acknowledged and the alarm system is reset.

6.4 Accessing On-screen Help for Technical Alarms (AlarmSight)

In the technical alarm list, alarm messages followed by Detail include help messages or pictures to help you identify the problem. This function is called AlarmSight. To access AlarmSight, follow this procedure:

1. Select an alarm displaying in the technical alarm information area to enter the Alarms dialog.
2. From the alarm list select the desired alarm.

NOTE

- If there are no displayed alarms, then selecting the technical alarm area will not open any dialogs.

6.5 Checking the Physiological Alarms List

If the patient monitor has more than one physiological alarm, you can see the physiological alarm list by selecting the physiological alarm information area to enter the Alarms dialog. If there is only one physiological alarm, selecting the physiological alarm information area enters the Review dialog for the event created by this alarm.

6.6 Changing Alarm Settings

Alarms settings can be changed by selecting Main Menu and choosing from the list in the Alarm column.
### 6.6.1 Setting Parameter Alarm Properties

To set parameter alarm properties, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Limits**.
2. Enter password if required.
3. Select a parameter tab and set alarm properties as desired.

You can also change the alarm properties of individual parameter from the corresponding parameter dialog.

![Alarm Properties](image)

### 6.6.2 Changing the Alarm Volume

To change the alarm volume, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Setup**.
2. Set **Alarm Volume**. The alarm volume can be set from X to 10, in which X is the minimum volume allowed by your department, and 10 is the maximum volume.
3. Select **High Alarm Volume** to set the volume of the high priority alarm.
4. Select **Reminder Volume** to set the volume of the reminder tone.

**NOTE**

- **When the alarm volume is set to 0, the alarm sound is turned off and the audio off symbol appears on the screen.**
- **You cannot set the volume of high priority alarms if Alarm Volume is set to 0.**
- **You can set the Alarm Volume to 0 only when your monitor is connected to the CMS. If your monitor is not connected to the CMS, the minimum setting of Alarm Volume is 1.**
- **When your monitor is connected to the CMS and Alarm Volume is set to 0, the Alarm Volume automatically changes to 2 if the CMS is disconnected.**

### 6.6.3 Setting the Auto Limits for New Patient Switch

If the **Auto Limits for New Patient** function is enabled, a dialog box can pop up to ask you whether to set alarm limits based on the latest parameter measurements for a newly admitted patient. To set the **Auto Limits for New Patient** switch, follow this procedure:

1. Enter the alarm setup page in any of the following ways:
   - Select the **Alarm Setup** quick key → select the **Setup** tab.
   - Select the **Main Menu** quick key → from the **Alarm** column select **Setup**.
2. Set the **Auto Limits for New Patient** switch.
When **Auto Limits for New Patient** is switched on, the confirmation dialog box pops up if all of the following requirements are met:

- Within 10 minutes after the patient is admitted.
- Continuous measurements are stable.
- An NIBP measurement has been taken
- HR alarm switch is on.
- No fatal alarms are triggered.
- The patient is not in poor perfusion condition.
- Alarm limit of any parameter was not manually changed.
- The monitor is not in intubation mode, rescue mode, private mode, or CPB mode.

**NOTE**

- The Auto Limits for New Patient function is intended for newly admitted patients only.
- The automatically set alarm limits take effect only after being confirmed.

### 6.6.4 Initiating Auto Alarm Limits

The monitor provides the auto alarm limits function to automatically adjust alarm limits according to the patient’s vital signs. When auto limits are selected, the monitor calculates safe auto limits based on the latest measured values. To get accurate auto alarm limits, collect a set of measured vital signs as a baseline.

To initiate auto alarm limits, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Limits**.
2. From the **Limits** page, select **Auto Limits** at the left bottom.
3. Select **OK** from the popup dialog box.

Then the monitor will automatically calculate alarm limits based on the latest measured values. Before applying these automatically created alarm limits, confirm if they are appropriate for the patient from the **Limits** dialog. If not, you can adjust them manually. These alarm limits will remain unchanged until you select auto limits again or adjust them manually.

The monitor calculates auto limits based on the following rules:

<table>
<thead>
<tr>
<th>Module</th>
<th>Parameter</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>Auto Limit Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Adult/ pediatric</td>
<td>Neonate</td>
<td>Adult/ pediatric</td>
</tr>
<tr>
<td>ECG</td>
<td>HR/PR (bpm)</td>
<td>HR × 0.8 or 40 (whichever is greater)</td>
<td>(HR - 30) or 90 (whichever is greater)</td>
<td>HR × 1.25 or 240 (whichever is smaller)</td>
</tr>
<tr>
<td>Resp</td>
<td>RR (rpm)</td>
<td>RR × 0.5 or 6 (whichever is greater)</td>
<td>(RR - 10) or 30 (whichever is greater)</td>
<td>(RR × 1.5) or 30 (whichever is smaller)</td>
</tr>
<tr>
<td>SpO₂</td>
<td>SpO₂ (%)</td>
<td>Same as the default alarm limit</td>
<td>Same as the default alarm limit</td>
<td>Same as the default alarm limit</td>
</tr>
<tr>
<td>Module</td>
<td>Parameter</td>
<td>Lower Limit</td>
<td>Upper Limit</td>
<td>Auto Limit Range</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>-------------</td>
<td>-------------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adult/ pediatric</td>
<td>Neonate</td>
<td>Adult/ pediatric</td>
</tr>
<tr>
<td>NIBP</td>
<td>NIBP-S (mmHg)</td>
<td>(SYS × 0.68 + 10)</td>
<td>(SYS - 15) or 45 (whichever is greater)</td>
<td>(SYS × 0.86 + 38)</td>
</tr>
<tr>
<td></td>
<td>NIBP-D (mmHg)</td>
<td>(Dia × 0.68 + 6)</td>
<td>(Dia - 15) or 20 (whichever is greater)</td>
<td>(Dia × 0.86 + 32)</td>
</tr>
<tr>
<td></td>
<td>NIBP-M (mmHg)</td>
<td>(Mean × 0.68 + 8)</td>
<td>(Mean - 15) or 35 (whichever is greater)</td>
<td>(Mean × 0.86 + 35)</td>
</tr>
<tr>
<td>Temp</td>
<td>T1 (°C)</td>
<td>(T1 - 0.5)</td>
<td>(T1 - 0.5)</td>
<td>(T1 + 0.5)</td>
</tr>
<tr>
<td></td>
<td>T2 (°C)</td>
<td>(T2 - 0.5)</td>
<td>(T2 - 0.5)</td>
<td>(T2 + 0.5)</td>
</tr>
<tr>
<td></td>
<td>ΔT (°C)</td>
<td>Same as the default alarm limit</td>
<td>Same as the default alarm limit</td>
<td>Same as the default alarm limit</td>
</tr>
<tr>
<td>IBP: ART/Ao/UAP/BAP/FAP/LV/P1-P4 (Arterial pressure)</td>
<td>IBP-S (mmHg)</td>
<td>SYx × 0.68 + 10</td>
<td>(SYS - 15) or 45 (whichever is greater)</td>
<td>SYx × 0.86 + 38</td>
</tr>
<tr>
<td></td>
<td>IBP-D (mmHg)</td>
<td>(Dia × 0.68 + 6)</td>
<td>(Dia - 15) or 20 (whichever is greater)</td>
<td>(Dia × 0.86 + 32)</td>
</tr>
<tr>
<td></td>
<td>IBP-M (mmHg)</td>
<td>Mean × 0.68 + 8</td>
<td>(Mean - 15) or 35 (whichever is greater)</td>
<td>Mean × 0.86 + 35</td>
</tr>
<tr>
<td>IBP: PA</td>
<td>IBP-S (mmHg)</td>
<td>SYx × 0.75</td>
<td>SYx × 0.75</td>
<td>SYx × 1.25</td>
</tr>
<tr>
<td></td>
<td>IBP-D (mmHg)</td>
<td>Dia × 0.75</td>
<td>Dia × 0.75</td>
<td>Dia × 1.25</td>
</tr>
<tr>
<td></td>
<td>IBP-M (mmHg)</td>
<td>Mean × 0.75</td>
<td>Mean × 0.75</td>
<td>Mean × 1.25</td>
</tr>
<tr>
<td>IBP: CPP</td>
<td>CPP (mmHg)</td>
<td>CPP × 0.68 + 8</td>
<td>(CPP-15) or 35, (whichever is greater)</td>
<td>CPP × 0.86 + 35</td>
</tr>
<tr>
<td>IBP: CVP/LAP/RAP/UVP/P1-P4 (Venous pressure)</td>
<td>IBP-M (mmHg)</td>
<td>Mean × 0.75</td>
<td>Mean × 0.75</td>
<td>Mean × 1.25</td>
</tr>
</tbody>
</table>
6.6.5 Setting the Zero RR Delay Time

To set the zero respiration rate delay time, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Setup**.
2. Select Zero RR to set the zero respiration rate delay time.

6.6.6 Restoring the Default Alarm Settings

To reset all alarm settings to the defaults, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Limits**.
2. On the **Limits** page, select **Defaults** at the bottom.

6.6.7 Setting the Length of Printed Waveforms

You can define the length of printed waveforms when an alarm is triggered. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Setup**.
2. Set **Printing Duration On Alarm**.

6.7 Pausing Alarms/Pausing Alarm Tones

You can either pause alarms or pause alarm tones. This depends on the pause setting. To set the pause function, refer to 21.3.3 Defining the Pause Function.

6.7.1 Pausing Alarms

If the Pause function is configured to alarm pause, pressing the **Alarm Pause** quick key can temporarily disable alarm indicators. For the configuration of the pause function, see section 21.3.3 Defining the Pause Function.

When alarms are paused, the following rules are followed:

- No physiological alarm will be presented.
For technical alarms, alarm sounds are paused, but alarm lamps and alarm messages continue to be presented.

- The remaining alarm pause time is displayed in the physiological alarm information area.
- The alarm pause symbol is displayed in the system information area.

When the alarm pause time expires, the alarm paused state is automatically deactivated. You can also cancel the alarm paused state by pressing the **Alarm Pause** quick key again.

### 6.7.1 Prolonging the Alarm Pause Time

If enabled, you can temporarily prolong the alarm pause time after the monitor enters the alarm paused state. This capability is disabled by default. To prolong the alarm pause time, follow this procedure:

1. In the physiological alarm information area, select the alarm pause countdown.
2. Select **Pause 5 min**, **Pause 10 min**, or **Pause 15 min**.

**NOTE**

- Prolonging alarm pause time does not affect the setting of alarm pause time.

### 6.7.2 Switching Off All Alarms

If **Pause Time** is set to **Permanent** (see section 21.3.3.1 Setting the Alarm Pause Time/Alarm Tone Pause Time), pressing the **Alarm Pause** quick key permanently switches off all alarms. The alarm off state has the following features:

- Physiological alarms are switched off. The alarm lamp does not flash and alarm sound is not issued.
- Alarm sound of technical alarms is switched off, but alarm lamp flashes and alarm messages are presented.
- The message **Alarm Off** with red background is displayed in the physiological alarm information area.
- The alarm off symbol is displayed in the system status information area.

To exit the alarm off state, press the **Alarm Pause** quick key again.

**WARNING**

- Pausing or switching off alarms may result in a hazard to the patient.

### 6.7.2 Pausing Alarm Sound

If the Pause function is configured to Audio Pause, pressing the **Audio Pause** quick key pauses alarm tone and sets the quick key to be highlighted. For the configuration of the pause function, see section 21.3.3 Defining the Pause Function. When alarm tones are paused, the following rules are followed:

- The sound of all physiological alarms and technical alarms are switched off.
- The remaining audio pause time is displayed in the physiological alarm information area.
- The audio pause symbol is displayed in the system information area.

When the audio pause time expires, the audio paused state is automatically deactivated. You can also cancel the audio paused state by pressing the highlighted **Audio Pause** quick key again.

### 6.7.2.1 Prolonging the Alarm Tone Pause Time

If enabled, you can temporarily prolong the alarm tone pause time after the monitor enters the alarm tone paused state. This capability is enabled by default. To prolong the audio pause time, follow this procedure:

1. In the physiological alarm information area, select the alarm pause countdown.
2. Select the alarm tone pause time. Options may include **Pause 5 min**, **Pause 10 min**, or **Pause 15 min**.
NOTE

• Prolonging alarm pause time does not affect the setting of alarm tone pause time.

6.7.2.2 Switching Off Alarm Sound

If Pause Time is set to Permanent (see section 21.3.3.1 Setting the Alarm Pause Time/Alarm Tone Pause Time), pressing the Audio Pause quick key permanently switches off all alarm sound. The audio off state has the following features:

■ Alarm sound of both physiological alarms and technical alarms is switched off.
■ The audio off symbol is displayed in the system information area.

To exit the audio off state, press the Audio Pause quick key again.

WARNING

• Pausing or switching off alarm sound may result in a hazard to the patient.

6.8 Resetting Alarms

Press the Alarm Reset quick key to acknowledge the ongoing alarms and reset the alarm system. When the alarm system is reset, the alarm reset symbol displays in the system status information area for alarm symbols.

NOTE

• If a new alarm is triggered after the alarm system is reset, the alarm reset icon will disappear and the alarm light and alarm tone will be reactivated.

6.8.1 Resetting Physiological Alarms

For physiological alarms, when the alarm system is reset, the following occur:

■ The alarm sound is silenced.
■ A √ appears before the alarm message, indicating that the alarm is acknowledged.
■ The color of the parameter numeric background corresponds with the alarm priority, but the parameter numeric does not flash.

6.8.2 Resetting Technical Alarms

For technical alarms, when the alarm system is reset, the following occur:

■ Some technical alarms are cleared. The monitor gives no alarm indications.
■ Some technical alarms are changed to prompt messages.
■ For some technical alarms, the alarm is silenced and a √ appears before the alarm message, indicating that the alarm is acknowledged.

For details about the indications of technical alarms when the alarm system is reset, see D.2 Technical Alarm Messages.

6.9 Latching Alarms

The latching setting for physiological alarms defines how alarm indicators behave if you do not reset the alarms.

■ If you do not “latch” physiological alarms, their alarm indications disappear when the alarm condition ends.
■ If you “latch” physiological alarms, all visual and audible alarm indications remains (if configured) until the alarms are reset. For latched alarms the time when the alarm is last triggered is displayed behind the alarm message.
The monitor can be set to separately latch visual indications or simultaneously latch the visual and the audible indications.

- When visual indications are latched, visual indications, including alarm lamp, alarm message and its background remains when the alarm condition ends and the time when the alarm last triggered is displayed behind the alarm message.
- When audible indications are latched, the monitor continues to issues alarm sounds when the alarm condition ends.

To set how you want to latch the physiological alarms, see section 21.3.4 Latching Physiological Alarms.

**NOTE**

- Changing alarm priority may affect the latching status of the corresponding alarm. Determine if you need to adjust the latching status for the specific alarm when you have changed its alarm priority.
- When the alarm system is reset, latched physiological alarms are cleared.

### 6.10 CPB Mode

The CPB (Cardiopulmonary Bypass) mode is activated only if you set the department to **OR**.

In the CPB mode, all the physiological alarms and technical alarms are switched off. So when performing CPB, you can put the monitor in the CPB mode to inactivate unnecessary alarms.

#### 6.10.1 Entering the CPB Mode

To enter the CPB mode, select the **Main Menu** quick key from the **Alarm** column select **CPB Mode**.

In the CPB mode, **CPB Mode** is displayed in the physiological alarm area with a red background color.

**NOTE**

- When the CPB mode is entered, the monitor stops all NIBP measurements. You can restart NIBP measurements after entering the CPB mode.

#### 6.10.2 Exiting the CPB Mode

To exit the CPB mode, select the **Main Menu** quick key from the **Alarm** column select **Exit CPB Mode**.

### 6.11 Intubation Mode

Intubation mode is available for Resp and CO₂ monitoring. When performing intubation during general anesthesia, you can put the monitor in the intubation mode in order to inactivate unnecessary alarms.

In the intubation mode, Resp and CO₂ related physiological alarms are switched off.

#### 6.11.1 Entering the Intubation Mode

To enter the intubation mode, choose either of the following ways:

- From the bottom of the **Resp** or **CO₂** dialog, select **Intubation Mode**.
- Select the **Main Menu** quick key from the **Alarm** column select **Intubation Mode**.

#### 6.11.2 Exiting the Intubation Mode

To exit the intubation mode, choose either of the following ways:

- From the bottom of the **Resp** or **CO₂** dialog, select **Exit Intubation Mode**.
- Select the **Main Menu** quick key from the **Alarm** column select **Exit Intubation Mode**.
6.12 Testing Alarms

The monitor automatically performs a self test at startup. Check that an alarm tone is heard, the alarm lamp illuminates, one after the other, in red, yellow, and cyan. This indicates that the visible and audible alarm indicators functions correctly.
7 Monitoring ECG, Arrhythmia, ST and QT

7.1 ECG Introduction

The electrocardiogram (ECG) measures the electrical activity of the heart and displays it on the monitor as waveforms and numerics. ECG monitoring provides 3-, 5-, 6-, and 12-lead ECG monitoring, ST-segment analysis, arrhythmia analysis, QT/QTc measurements, and optional 12-lead resting analysis via the Glasgow algorithm.

The N1 monitor incorporating ST analysis has the ST label.

The N1 monitor incorporating 12-lead has the 12-lead label.

7.2 ECG Safety Information

**WARNING**

- This equipment is not intended for direct cardiac application.
- Ensure that the conductive parts of ECG electrodes and associated connectors, including the neutral electrode, do not come into contact with any other conductive parts including earth.
- Always use defibrillation-proof ECG cables during defibrillation.
- Do not touch the patient, or metal devices connected to the patient, during defibrillation.
- To minimize the hazard of burns during high-frequency surgical procedures, ensure that the monitor’s cables and transducers never come into contact with the electrosurgery unit (ESU).
- To minimize the hazard of burns during use of high-frequency surgical unit (ESU), the ECG electrodes should not be located between the surgical site and the ESU return electrode.

**CAUTION**

- Only use parts and accessories specified in this manual. Follow the instructions for use and adhere to all warnings and cautions.
- Periodically inspect the electrode application sites to ensure skin integrity. If the skin quality changes, replace the electrodes or change the application site.
• Interference from an ungrounded instrument near the patient or electrosurgery usage can induce noise and artifact into the waveforms.

7.3 ECG Display

The following figures show the ECG waveform and numeric areas. The display may be configured to look slightly different.

(1) ECG lead label of the displayed waveform  (2) ECG waveform gain
(3) ECG filter mode  (4) Notch filter status
(5) Paced status: If Paced is set to Yes, ♥ is displayed. If Paced is set to No, ☹️ is displayed.
(6) Pace pulse marker: If Paced is set to Yes, pace pulse markers ™ are displayed corresponding to detected pacer for each beat.

(1) Parameter label  (2) HR measurement unit
(3) HR alarm limits  (4) HR value

7.4 Preparing for ECG Monitoring

7.4.1 Preparing the Patient Skin

Proper skin preparation is necessary to ensure good signal quality at the electrode sites, as the skin is a poor conductor of electricity. To properly prepare the skin, choose flat areas and then follow this procedure:
1. Shave hair from skin at chosen electrode sites.
2. Gently rub skin surface at sites to remove dead skin cells.
3. Thoroughly cleanse the site with a mild soap and water solution. We do not recommend using ether or pure alcohol, because this dries the skin and increases the resistance.
4. Dry the skin completely before applying electrodes.

7.4.2 Applying Electrodes and Connecting the Patient

To connect ECG cables, follow this procedure:
1. Check that electrode packages are intact and the electrodes are not past the expiry date. Ensure the electrode gel is moist. If you are using snap electrodes, attach the snaps to the electrodes before placing electrodes on the patient.

2. Place the electrodes on the prepared sites. Ensure that all electrodes have good skin contact.

3. Connect the leadwires to the patient cable if not already connected.

4. Plug the patient cable into the ECG connector.

**CAUTION**

- Never mix patient electrode types or brands. This may lead to impedance mismatches issues.

**NOTE**

- When applying the electrodes, avoid bony area, obvious layers of fat, and major muscles. Muscle movement can result in electrical interference. Applying electrodes on major muscles, for example on muscles of the thorax, may lead to erroneous arrhythmia alarms due to excessive muscle movement.

### 7.4.3 Lead Wire Color Code

The following table lists the color coding of leadwires for AHA standards:

<table>
<thead>
<tr>
<th>Lead</th>
<th>Label</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right arm</td>
<td>RA</td>
<td>White</td>
</tr>
<tr>
<td>Left arm</td>
<td>LA</td>
<td>Black</td>
</tr>
<tr>
<td>Right leg (neutral)</td>
<td>RL</td>
<td>Green</td>
</tr>
<tr>
<td>Left leg</td>
<td>LL</td>
<td>Red</td>
</tr>
<tr>
<td>Chest 1</td>
<td>V1</td>
<td>Brown/Red</td>
</tr>
<tr>
<td>Chest 2</td>
<td>V2</td>
<td>Brown/Yellow</td>
</tr>
<tr>
<td>Chest 3</td>
<td>V3</td>
<td>Brown/Green</td>
</tr>
<tr>
<td>Chest 4</td>
<td>V4</td>
<td>Brown/Blue</td>
</tr>
<tr>
<td>Chest 5</td>
<td>V5</td>
<td>Brown/Orange</td>
</tr>
<tr>
<td>Chest 6</td>
<td>V6</td>
<td>Brown/Violet</td>
</tr>
</tbody>
</table>

### 7.4.4 ECG Electrode Placements

In this section, electrode placement is illustrated using the AHA naming convention.

#### 7.4.4.1 3-leadwire Electrode Placement

The following is the electrode configuration when a 3-leadwire cable is used:

- **RA** placement: directly below the clavicle and near the right shoulder.
- **LA** placement: directly below the clavicle and near the left shoulder.
- **LL** placement: on the left lower abdomen.
7.4.4.2 5-leadwire and 6-leadwire Electrode Placement

The following is the electrode configuration for a 5-leadwires cables:

- RA placement: directly below the clavicle and near the right shoulder.
- LA placement: directly below the clavicle and near the left shoulder.
- RL placement: on the right lower abdomen.
- LL placement: on the left lower abdomen.
- V placement: on the chest in any of the V1 to V6 positions.

For 6-leadwire placement, you can use the position for the 5-leadwire placement but with two chest leads. The two chest leads (Va and Vb) can be positioned at any two of the V1 to V6 positions. For more information, see 7.4.4.3 Chest Electrode Placement. The Va and Vb lead positions are configurable. For more information, see 7.5.3.3 Changing Va and Vb Labels.

7.4.4.3 Chest Electrode Placement

The chest electrode can be placed at the following positions:

- V1 placement: on the fourth intercostal space to the right of the sternum.
- V2 placement: on the fourth intercostal space to the left of the sternum.
- V3 placement: midway between the V2 and V4 electrode positions.
- V4 placement: on the fifth intercostal space at the left midclavicular line.
- V5 placement: on the left anterior axillary line, horizontal with the V4 electrode position.
- V6 placement: on the left midaxillary line, horizontal with the V4 electrode position.
- V3R-V6R placement: on the right side of the chest in positions corresponding to those on the left.

**NOTE**

- For the 5-leadwire and 6-leadwire placement, place the precordial electrode according to the physician’s preference.
7.4.4 10-leadwire Electrode Placement

12-lead ECG uses 10 electrodes, which are placed on the patient’s four limbs and chest. The limb electrodes should be placed on the limb extremities and the chest electrodes placed according to the physician’s preference. The figure at right illustrates the conventional 10-leadwire electrode placement.

7.4.5 Lead Placement for Surgical Patients

The surgical site should be taken into consideration when placing electrodes on a surgical patient. For example, for open-chest surgery, the chest electrodes can be placed on the lateral chest or back. To reduce artifacts and interference from electrosurgical units, you can place the limb electrodes close to the shoulders and lower abdomen and the chest electrodes on the left side of the mid-chest. Do not place the electrodes on the upper arm. Otherwise, the ECG waveform will be very small.

WARNING

- To reduce the hazard of burns during use of electrosurgical units (ESU), the ECG electrodes should not be located between the surgical site and the ESU return electrode.
- Never entangle the ESU cable and the ECG cable together.
- When using ESU, never place ECG electrodes near the grounding plate of the ESU, as this can cause a lot of interference on the ECG signal.

7.4.6 Choosing the ECG Lead Type

To choose ECG lead type, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Set Lead Set according to the lead type you are going to use. The default lead type is Auto. In this case, the monitor automatically detects the lead type.

7.4.6 Checking Paced Status

It is important to correctly set the patient’s paced status before you start monitoring ECG. The paced symbol is displayed when Paced is set to Yes. Pace pulse markers are displayed on each ECG waveform whenever a pacer signal is detected. If Paced is set to No or unspecified, the symbol will be shown in the ECG waveform area.

To change the paced status, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Pacer tab.
3. Set Paced to Yes or No.
You can also change the patient’s paced status from the Patient Management dialog. For more information, see 4.2.1 Entering the Patient Management Menu.

If you did not set the paced status, the monitor issues a prompt tone when pace pulse is detected. At the same time, the paced symbol 🚁 flashes and the message Please check if the patient has a pacemaker? appears in the ECG waveform area. Check and set the patient’s paced status.

**WARNING**

- For paced patients, you must set Paced to Yes. If it is incorrectly set to No, the monitor could mistake a pace pulse for a QRS complex and fail to alarm when the ECG signal is too weak. On ventricular paced patients, episodes of ventricular tachycardia may not always be detected. Do not rely entirely upon the system’s automated arrhythmia detection algorithm.
- False low heart rate or false asystole alarms may result with certain pacemakers because of pacemaker artifacts, such as electrical overshoot of the pacemaker overlapping the true QRS complexes.
- Do not rely entirely on rate meter alarms when monitoring patients with pacemakers. Always keep these patients under close surveillance.
- The auto pacer recognition function is not applicable to pediatric and neonatal patients.

### 7.4.7 Enabling Pacer Rejection

The pace pulse rejection function is disabled by default. To enable this function, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Pacer tab.

**NOTE**

- When pace pulses are detected, the pace pulse markers “|” are shown on the ECG waveforms. Pacer Rejection setting has no impact on the display of pace pulse markers “|”.
- You can switch on pacer rejection only when Paced is set to Yes. If Paced is set to no, the Pacer Reject function is disabled.

### 7.5 Changing ECG Settings

#### 7.5.1 Choosing an ECG Screen

When monitoring ECG, several display options are available.

- For 3-lead ECG monitoring, only normal screen is available.
- For 5-lead ECG monitoring, besides the normal screen, you can also choose Full-screen (7-lead).
- For 6-lead ECG monitoring, besides the normal screen, you can also choose Full-screen (8-lead). For 12-lead ECG monitoring, besides the normal screen, you can also choose Full-screen (7-lead), or 12-Lead (12-lead analysis).

To choose the desired screen configuration, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select Full-Screen, or 12-Lead when visible.

To return to the normal screen, press the highlighted button to unselect that screen.

Alternately you can choose the desired screen configuration as follows:

1. Select the Screen Setup quick key → Choose Screen or select the Main Menu quick key → from the Display column select Choose Screen.
2. Select ECG Full-Screen, or ECG 12-Lead.
7.5.2 Setting ECG Alarm Properties

To select the desired ECG alarm options, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Alarm tab.
3. Select the desired alarm options.

7.5.3 Changing ECG Wave Settings

7.5.3.1 Selecting the Leads of Displayed ECG Waveforms

To select the desired ECG waveforms to be displayed, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Select ECG to set the lead of each displayed ECG waveform.
4. If more than three ECG waveforms are to be displayed, select the More Leads tab, and then select ECG to set leads of other ECG waveforms.

For optimal ECG analysis, select leads with the following characteristics:
- The QRS complex should be either completely above or below the baseline and it should not be biphasic.
- The QRS complex should be tall and narrow.
- The P waves and T waves should be less than 0.2mV.

CAUTION

- Ensure that you have selected the optimal leads with the best waveform amplitude and the highest signal-to-noise ratio. Selecting the optimal leads is important for detecting beats, classifying beats, and detecting ventricular fibrillation.

7.5.3.2 Changing ECG Waveform Size

If the ECG waveform is too small or clipped, you can change its size by selecting the appropriate Gain setting. To do so, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Select ECG gain to set the size of each ECG waveform.
4. If more than three ECG waveforms are displayed, select the More Leads tab, and then select ECG Gain to change the sizes of other ECG waveforms. If you select Auto, the monitor automatically adjusts the size of the ECG waveforms for all the leads.

7.5.3.3 Changing Va and Vb Labels

When monitoring ECG with 6-leadwire. You can change the labels of Va and Vb leads. To do so, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Set Va and Vb according to the locations of the Va and Vb electrode sites. Default settings are Va and Vb.

7.5.3.4 Changing ECG Waveform Speed

To change ECG waveform speed, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Set the desired Speed.

7.5.3.5 Setting the ECG Filter
To set the appropriate ECG waveform filter mode, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Set Filter.
   ◆ **Diagnostic**: use when diagnostic quality ECG is required. The unfiltered ECG waveform is displayed so that changes such as R-wave notching or discrete elevation or depression of the ST segment are visible.
   ◆ **Monitor**: use under normal monitoring conditions.
   ◆ **Surgery**: use when the signal is distorted by high frequency or low frequency interference. High frequency interference usually results in large amplitude spikes making the ECG signal look irregular. Low frequency interference usually leads to wandering or rough baseline. The surgery filter reduces artifacts and interference from electrosurgical units. Under normal measurement conditions, selecting Surgery may suppress certain features or details of the QRS complexes.
   ◆ **ST**: recommended for ST monitoring.

7.5.3.6 Switching On or Off the Notch Filter
The notch filter removes the line frequency interference. To switch on or off the notch filter, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Switch on or off Notch Filter.

**NOTE**
* The notch filter can only be switched on or off when ECG Filter is set to Diagnostic. In other filter modes, the notch filter is always on.

7.5.4 Disabling the Smart Lead Off Function
The monitor provides the smart lead off function. When the lead corresponding to the first ECG wave gets detached but another lead is available, the monitor automatically switches to the available lead to recalculate heart rate, and to analyze and detect arrhythmias. When you reconnect the detached leads, the monitor automatically switches back to the original lead.

The smart lead off function is enabled by default. To disable this function, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Switch off Smart Lead.

7.5.5 Adjusting the QRS Volume
To adjust the QRS volume, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Set QRS Volume.

When valid SpO₂ measurements are available, the monitor adjusts the pitch of QRS tone based on the SpO₂ value.
7.5.6 Adjusting the Minimum QRS Detection Threshold

To avoid false asystole alarm due to low R wave amplitude, and to avoid tall T waves and P waves being mistaken for QRS complexes, the monitor provides a means to manually adjust the minimum QRS detection threshold.

To adjust the minimum QRS detection threshold, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab and set Filter to Monitor.
3. Select the QRS Threshold tab.
4. Select up or down arrow buttons to adjust the minimum threshold for QRS detection. Selecting Default resets the QRS threshold to the default value (0.16 mV).

CAUTION

- The setting of the QRS detection threshold can affect the sensitivity for arrhythmia, ST, QT/QTc detection, and heart rate calculation.
- If the QRS amplitude is low, the monitor might not be able to detect the beats and false asystole calls may occur.

NOTE

- The minimum QRS detection threshold can only be adjusted when the ECG filter is set to Monitor.

7.6 Monitoring Arrhythmia

Arrhythmia monitoring is intended for adult and pediatric patients.

7.6.1 Arrhythmia Safety Information

WARNING

- Heart rate reading may be affected by cardiac arrhythmias. Do not rely entirely on heart rate alarms when monitoring patients with arrhythmias. Always keep these patients under close surveillance.
- The arrhythmia analysis program is intended to detect ventricular arrhythmias and atrial fibrillation. It is not designed to detect all the atrial or supraventricular arrhythmias. It may incorrectly identify the presence or absence of an arrhythmia. Therefore, a physician must analyze the arrhythmia information with other clinical findings.
- Atrial fibrillation (Afib) detection function is not intended for pediatric and neonatal patients.

CAUTION

- Since the arrhythmia detection algorithm sensitivity and specificity are less than 100%, it is possible for false arrhythmias to be detected and true arrhythmia events to not be detected. The possibility increases when the signal is noisy.
- The ECG size and minimum QRS detection threshold settings affect arrhythmia detection and heart rate calculation sensitivity.
- If QRS amplitude is low, the monitor might be unable to calculate heart rate and thus create false asystole calls. During the learning phase of the algorithm, arrhythmia detection may not be available. It is recommended to closely monitor patient condition during, and for several minutes after, the learning phase to allow the algorithm to reach optimal detection performance.

7.6.2 Arrhythmia Events

This section lists all arrhythmia events and their criteria.
### 7.6.2.1 Lethal Arrhythmia Events

<table>
<thead>
<tr>
<th>Arrhythmia message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asystole</td>
<td>No QRS complex detected within the set time interval in the absence of ventricular fibrillation or chaotic signal.</td>
</tr>
<tr>
<td>V-Fib/V-Tach</td>
<td>A fibrillatory wave for 6 consecutive seconds. A dominant rhythm of adjacent PVCs and the ventricular rate is greater than the V-tach rate limit.</td>
</tr>
<tr>
<td>V-Tach</td>
<td>The number of consecutive PVCs is greater than or equal to the V-Tach PVCs limit, and the ventricular rate is greater than or equal to the V-Tach rate limit.</td>
</tr>
</tbody>
</table>

### 7.6.2.2 Nonlethal Arrhythmia Events

<table>
<thead>
<tr>
<th>Arrhythmia message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent Brady</td>
<td>The number of consecutive PVCs is greater than or equal to V brady PVC limit and the ventricular rate is less than the V-Brady rate limit.</td>
</tr>
<tr>
<td>Extreme Tachy</td>
<td>The heart rate is greater than the extreme tachycardia limit.</td>
</tr>
<tr>
<td>Extreme Brady</td>
<td>The heart rate is less than the extreme bradycardia limit.</td>
</tr>
<tr>
<td>R on T</td>
<td>R on T PVC is detected.</td>
</tr>
<tr>
<td>Run PVCs</td>
<td>More than two consecutive PVCs, but lower than the V-Brady PVCs limit, and the ventricular rate is lower than the V-Tach rate limit.</td>
</tr>
<tr>
<td>Couplet</td>
<td>A Pair of PVCs detected in between normal beats.</td>
</tr>
<tr>
<td>Multiform PVC</td>
<td>Multiform PVCs detected in Multif. PVC’s Window (which is adjustable).</td>
</tr>
<tr>
<td>PVC</td>
<td>One PVC detected in between normal beats.</td>
</tr>
<tr>
<td>Bigeminy</td>
<td>A dominant rhythm of N, V, N, V, N, V*.</td>
</tr>
<tr>
<td>Trigeminy</td>
<td>A dominant rhythm of N, N, V/N, N, V, N, N, V*.</td>
</tr>
<tr>
<td>Tachy</td>
<td>The heart rate is greater than the tachycardia limit.</td>
</tr>
<tr>
<td>Brady</td>
<td>The heart rate is lower than the bradycardia limit.</td>
</tr>
<tr>
<td>Pacer not Capture</td>
<td>No QRS complex detected for 300 ms following a pace pulse (for paced patients only).</td>
</tr>
<tr>
<td>Pacer not Pacing</td>
<td>No pace pulse detected for 1.75 x average R-to-R intervals following a QRS complex (for paced patients only).</td>
</tr>
<tr>
<td>Missed Beat</td>
<td>At least 3 consecutive Ns*, and The current RR interval is greater than 1.5 x previous RR interval, and The next RR interval is lower than 1.5 x average RR interval, and HR lower than 100 and the current RR interval is greater than 1.75 x average RR interval , or HR is greater than or equal to 100 and the current RR interval is greater than 1000 ms.</td>
</tr>
<tr>
<td>Nonsus V-Tach</td>
<td>The number of consecutive PVCs is lower than the V-Tach PVCs limit but greater than 2, and the ventricular rate is greater than or equal to the V-Tach Rate limit.</td>
</tr>
<tr>
<td>Vent Rhythm</td>
<td>The number of consecutive PVCs is greater than or equal to the V-Brady PVCs limit, and ventricular rate is greater than or equal to the V-Brady Rate limit but lower than V-Tach Rate limit.</td>
</tr>
<tr>
<td>Pause/min</td>
<td>No QRS complex is detected within the set pause time threshold.</td>
</tr>
<tr>
<td>Irr Rhythm</td>
<td>Consistently irregular rhythm (N*, irregular RR interval change is greater than 12.5%)</td>
</tr>
<tr>
<td>A-Fib (for adult only)</td>
<td>P wave is absent and normal beat RR intervals are irregular.</td>
</tr>
<tr>
<td>PVCs/min</td>
<td>PVCs/min exceeds high limit.</td>
</tr>
<tr>
<td>Pauses/min</td>
<td>Pauses/min exceeds high limit.</td>
</tr>
</tbody>
</table>
7.6.3 Displaying Arrhythmia Information

You can display the arrhythmia information in the numeric area. To do so, follow this procedure:

1. Access **Tile Layout** using either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Click the numeric area where you want to display the arrhythmia information, and then select ECG → Arrhythmia.

7.6.4 Changing Arrhythmia Settings

7.6.4.1 Changing Arrhythmia Alarm Settings

To set the arrhythmia alarm properties, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** dialog.
2. Select the **Arrhythmia** tab → **Alarm** tab.
3. Set alarm properties as desired.

**NOTE**

- You can switch off lethal arrhythmia alarms only when the monitor is set to enable **Lethal Arrhythmia Alarms Off**. For more information, see 21.3.9.1 Setting the Lethal Arrhythmia Alarms Switch.
- The priority of lethal arrhythmia alarms is always high. It cannot be altered.

7.6.4.2 Changing Arrhythmia Alarm Threshold Settings

You can change threshold settings for certain arrhythmia alarms. When an arrhythmia exceeds its threshold, an alarm will be triggered. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** dialog.
2. Select the **Arrhythmia** tab → select the **Threshold** tab.
3. Enter the password if required. For more information, refer to 21.12.3 Selecting Password for User Authentication.
4. Set the threshold for the desired arrhythmia alarms.

**NOTE**

- The asystole delay time relates to ECG relearning. When heart rate is less than 30 bpm, it is recommended to set Asystole Delay to 10 sec.

7.6.4.3 Arrhythmia Threshold Range

<table>
<thead>
<tr>
<th>Arrhythmia</th>
<th>Threshold Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asystole Delay</td>
<td>3 sec to 10 sec</td>
</tr>
<tr>
<td>Tachy (HR High)</td>
<td>60 bpm to 295 bpm</td>
</tr>
<tr>
<td>Brady (HR Low)</td>
<td>16 bpm to 120 bpm</td>
</tr>
</tbody>
</table>

*N*: normal beat; *V*: ventricular beat
### Setting Thresholds for PVC-Related Alarms

PVC-related alarms are detected on the basis of the current PVC rate and the number of consecutive PVCs. To set the required thresholds for PVC-related alarms, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the **Arrhythmia** tab → select the **More Threshold** tab.
3. Enter the password if required. For more information, refer to 21.12.3 Selecting Password for User Authentication.

Adjust **V-Tach PVCs**, **V-Tach Rate**, **V-Brady PVCs**, and **V-Brady Rate** as necessary to set the thresholds for the desired PVC-related alarms.

The following figure illustrates the conditions under which PVC alarms will be generated if **V-Tach PVCs** is set to 6, **V-Tach Rate** is set to 130, **V-Brady PVCs** is set to 5, and **V-Brady Rate** is set to 40.

<table>
<thead>
<tr>
<th>Arrhythmia</th>
<th>Threshold Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme Tachy</td>
<td>65 bpm to 300 bpm</td>
</tr>
<tr>
<td>Extreme Brady</td>
<td>15 bpm to 115 bpm</td>
</tr>
<tr>
<td>Multif PVCs Window</td>
<td>3 beats to 31 beats</td>
</tr>
<tr>
<td>V-Tach Rate</td>
<td>100 bpm to 200 bpm</td>
</tr>
<tr>
<td>V-Brady Rate</td>
<td>15 bpm to 60 bpm</td>
</tr>
<tr>
<td>V-Tach PVCs</td>
<td>3 beats to 99 beats</td>
</tr>
<tr>
<td>V-Brady PVCs</td>
<td>3 beats to 99 beats</td>
</tr>
<tr>
<td>PVCs/min High</td>
<td>1 to 100</td>
</tr>
<tr>
<td>Pauses/min</td>
<td>1 to 15</td>
</tr>
<tr>
<td>Pause Threshold</td>
<td>1.5 sec, 2.0 sec, 2.5 sec, 3.0 sec</td>
</tr>
<tr>
<td>AF/Irr Rhy End Time</td>
<td>0 min, 1 min, 2 min, 3 min, 4 min, 5 min, 10 min, 15 min, 30 min</td>
</tr>
</tbody>
</table>

If both V-Tach PVCs and V-Tach Rate are greater than or equal to the limits, a V-Tach alarm is generated.

- If the number of consecutive PVCs is lower than the V-Tach PVCs limit (6) but greater than 2, and PVC rate is greater or equal to the V-Tach Rate limit (130), a Nonsus V-Tach alarm is generated.
- If the number of consecutive PVCs is greater than or equal to the V-Brady PVCs limit (5), and PVC rate is lower than the V Brady limit (40), a Vent Brady alarm is generated.
■ If both the V-Brady PVCs and V-Brady Rate are lower than the limits, but V-Brady PVCs is greater than 2, a Run PVCs alarm is generated.
■ If the V-Brady PVCs and V-Brady Rate are greater than or equal to limits, but the Vent rate is is lower than V-Tach Rate (130), a Vent Rhythm alarm is generated.

7.6.5 Intelligent Arrhythmia Alarm

Normally, an arrhythmia alarm is presented when an alarm condition is detected. However, there are certain situations that can inhibit audible and visible alarm indications even though an alarm condition was detected. For more information, see 7.6.5.1 Arrhythmia Alarm Chains and 7.6.5.2 Arrhythmia Alarm Timeout Rules.

7.6.5.1 Arrhythmia Alarm Chains

If multiple alarms overlap, announcing all of the detected alarm conditions would be confusing, and a more serious condition might be overlooked. So arrhythmia alarms are prioritized by alarm "chains".

7.6.5.2 Arrhythmia Alarm Timeout Rules

The following table explains how audible and visual alarms are indicated during arrhythmia alarm timeout.

<table>
<thead>
<tr>
<th>Previous alarm</th>
<th>Current alarm</th>
<th>Alarm indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm in high priority chain</td>
<td>Alarm in high priority chain</td>
<td>Alarm light and alarm tone</td>
</tr>
<tr>
<td>Alarm in medium priority chain</td>
<td>Alarm in medium priority chain</td>
<td>During timeout period, alarm light and alarm tone are disabled. When the timeout period is reached, alarm light and alarm tone are reactivated.</td>
</tr>
</tbody>
</table>
7.6.5.3 Arrhythmia Alarm Refractory Period

For the following eight alarms in medium priority chain, there is a 30-second refractory period. That is to say, if the same alarm is not presented within 30 seconds after the previous alarm disappears.

- Couplet
- R on T
- PVCs/min High
- Multiform PVCs
- PVC
- Missed Beat
- Pacer not Capture
- Pacer not Pacing

7.7 ST Segment Monitoring

ST segment analysis is intended for adult, pediatric and neonatal patients. To use this feature, the N1 must be labeled to support ST analysis, see 7.1 ECG Introduction.

7.7.1 ST Safety Information

WARNING

- ST segment deviation values may be affected by such factors as certain drugs or metabolic and conduction disturbances.
- ST deviation is often calculated at a fixed offset from the J point. Changes in heart rate may affect ST.
- The significance of ST segment changes needs to be determined by a physician.
- This monitor provides information regarding changes in ST deviation levels. The clinical significance of the ST level change information should be determined by a physician.

7.7.2 Enabling ST Monitoring

The ST monitoring function is disabled by default. Before you start ST monitoring, enable the ST function. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the ST tab → select the Setup tab.
3. Switch on ST Analysis.

Reliable ST monitoring cannot be ensured under the following situations:

- You are unable to get a lead that is not noisy.
- Arrhythmias, such as atrial fibrillation or atrial flutter, which may cause an irregular baseline.
- The patient is continuously ventricularly paced.
- The patient has left bundle branch block.

In these cases, you may consider switching off ST monitoring.

### 7.7.3 Displaying ST Deviation Numerics

To display ST numerics, follow this procedure:

1. Access **Tile Layout** by either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Click the numeric area where you want to display the ST numerics, and then select **ECG → ST**.

The ST parameter display area is configured differently according to the ECG cable used:

- When you are using the 3-lead ECG leadwires, a separate ST numeric area does not appear on the display. The ST deviation value displays in the ECG numeric area.
- When you are using the 5-lead ECG leadwires, the ST numeric area displays 7 ST deviation values: ST-I, ST-II, ST-III, ST-aVR, ST-aVL, ST-aVF, ST-V.
- When you are using the 6-lead ECG leadwires, the ST numeric area displays 8 ST deviation values: ST-I, ST-II, ST-III, ST-aVR, ST-aVL, ST-aVF, ST-Va, ST-Vb.

This example shows the ST numeric area when 5-lead ECG cable is used. The monitor screen may look slightly different:

![ST Deviation Example](image)

(1) Parameter label  (2) ST measurement unit  
(3) ST alarm off symbol  (4) Lead labels  
(5) ST numerics: a positive value indicates ST segment elevation, and a negative value indicates ST segment depression.

### 7.7.4 Displaying ST Segments in the Waveform Area

You can display ST segments in the waveform area. To do so, follow this procedure:

1. Access **Tile Layout** by either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Select the waveform area where you want to display the ST segments, and then select **ECG → ST Segment**.
ST segment shows a QRS complex segment for each measured ST lead. The current ST segment is drawn in the same color as the ECG wave, usually green, superimposed over the stored reference segment, drawn in a different color. The information is updated once every ten seconds.

7.7.5 Entering the ST View

In ST View mode a complete QRS segment for each ST lead is displayed. The color of the current ST segments and ST deviation values is consistent with the color of the ECG waveforms, normally green. The color of the baseline ST segments and ST deviation values is white.

To enter the ST View, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the ST tab.
3. From the bottom of the dialog, select ST View.

7.7.6 Saving the Current ST Deviation and Segment as Baseline

ST deviation is typically monitored as a relative change from a baseline value. Set an ST baseline when ST deviation values become stable. If you did not set the ST baseline, the monitor automatically saves the baseline when valid ST deviation values appear for 5 minutes. To set the ST baseline, from the ST View, select Set Baseline. From the ST View, you can also perform the following operations:
- Display or hide ST baseline by selecting Display Baseline or Hide Baseline.
- Display or hide the position of ISO point, J point and ST point by selecting Display Marker or Hide Marker.

CAUTION

- Updating ST baseline affects ST alarms.

7.7.7 Entering the ST Graphic (only available when the N1 is used with the independent external display)

To display ST Graphic, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the ST tab.
3. Select ST Graphic.
The following figure shows the ST Graphic when **ST Alarm Mode** is set to **Absolute**. The height of the bar indicates the ST deviation value of corresponding ST lead. The color of the bar indicates ST alarm status: green indicates that corresponding ST deviation value is within alarm limits; cyan, yellow and red indicate that the ST deviation value exceeds the alarm limits. The color matches ST alarm priority.

![ST Graphic Absolute](image)

The following figure shows the ST Graphic when **ST Alarm Mode** is set to **Relative**. The height of grey bar indicates the baseline ST deviation value and the green bar (cyan, yellow or red if an alarm occurs) indicates relative ST from that baseline.

![ST Graphic Relative](image)

### 7.7.8 Changing ST Settings

#### 7.7.8.1 Setting ST Alarm Properties

To set ST alarm properties, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** dialog.
2. Select the **ST** tab → **Alarm** tab.
3. Set **ST Alarm Mode** to **Absolute** or **Relative**.
   - **Absolute**: you can separately set the alarm properties for each ST alarm for each lead.
   - **Relative**: you can set the alarm properties for **ST Single** and **ST Dual** alarms.
4. Set ST alarm properties.

#### 7.7.8.2 Changing Leads for ST Display

The monitor automatically selects the three most deviated leads for ST display. You can also manually select the leads. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** dialog.
2. Select the **ST** tab → select the **Setup** tab.
3. Set **ST Segment**. You can select up to 3 leads.
7.7.8.3  **Showing ISO Point, J Point, and ST Point Markers**

In the waveform area, the ISO point, J point, and ST point marker do not display on the ST segments by default. To display these markers, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the ST tab → select the Setup tab.
3. Switch on Show Markers.

7.7.9  **Adjusting ST Measurement Points**

7.7.9.1  **About ST Point, ISO Point, and J Point**

The ST deviation value for each beat is the potential difference between the isoelectric (ISO) point and the ST point. The ISO point provides the baseline. The ST point is located between the J point and the start of the T-wave. The J point is the end of the QRS complex. As the ST point is at a fixed distance away from the J point (40, 60, 80 etc msec), manually adjusting the J point helps you correctly position the ST point.

7.7.9.2  **Setting ST Point, ISO Point, and J Point**

**CAUTION**

- If Auto Adjust is Off, or if the patient’s heart rate or ECG morphology changes significantly, the ISO and ST points need to be occasionally adjusted because this may affect the QT interval and thus the location of the ST point. False ST segment depression or elevation may occur if the isoelectric point or the ST point is incorrectly set.

- Always ensure that the locations of ST points are appropriate for the patient.

To set the ST point, ISO point, and J point, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the ST tab → select the Adjust tab.
3. Set ST Point.

The setting for Auto Adjust defines the method of adjusting the ISO and J point locations. Auto Adjust is enabled by default. In this case, the locations of the ISO point and J point are automatically determined by the algorithm. When Auto Adjust is disabled, you need to manually adjust the position of the ISO point and J point using the arrows at the right sides of ISO and J.

- The ISO point (isoelectric) location shown is relative to the R-wave peak. Position the ISO point in the middle of the flattest part of the waveform (between the P and Q waves).
- The J point location is indicated relative to the R-wave peak. Position the J point at the end of the QRS complex and the beginning of the ST segment.
The ST point is positioned a fixed distance from the J point. Position the ST point relative to the J point at J+60/80ms, J+40ms, J+60ms or J+80ms. When J+60/80ms is selected, the ST point will be positioned 80 ms (heart rate 120 bpm or less) or 60 ms (heart rate more than 120 bpm) from the J point.

7.8 QT/QTc Interval Monitoring

The QT interval is the time between the beginning of the Q-wave and the end of the T-wave. It represents the total duration of the depolarization (QRS duration) and repolarization (ST-T) phases of the ventricles. QT interval monitoring can assist in the detection of long QT syndrome.

The QT interval has an inverse relationship to heart rate. Faster heart rates shorten QT interval and slower heart rates prolong QT interval. Therefore, several formulas are commonly used to correct the QT interval for heart rate. The heart rate corrected QT interval is abbreviated as QTc.

QT/QTc interval monitoring is intended for adult, pediatric, and neonatal patients.

7.8.1 QT/QTc Monitoring Limitations

Some conditions may make it difficult to achieve reliable QT/QTc monitoring, for example:

- R-wave amplitudes are too low
- The presence of frequent ventricular ectopic beats
- RR intervals are unstable
- P-waves tending to encroach on the end of the previous T-wave at high heart rates
- The T-wave is very flat or T-wave are not well defined
- The end of the T-wave is difficult to delineate because of the presence of U-waves
- QTc measurements are not stable
- In the presence of noise, asystole, ventricular fibrillation, atrial fibrillation, or ECG lead off

For reliable QT/QTc monitoring, choose lead with good T-wave amplitude and no visible flutter activity, and without a predominant U-wave or P-wave.

Some conditions such as left or right bundle branch block or ventricular hypertrophy can lead to a widened QRS complex. If a long QTc is observed you should verify it to ensure that it is not caused by QRS widening.

Because normal beats followed by ventricular beats are not included in the analysis, no QT measurement will be generated in the presence of a bigeminy rhythm.

If the heart rate is extremely high (over 150 bpm for adults and over 180 bpm for pediatrics and neonates), QT will not be measured. When the heart rate changes, it can take several minutes for the QT interval to stabilize. For reliable QTc calculation it is important to avoid measurements when the heart rate is changing.

7.8.2 Enabling QT/QTc Monitoring

The QT monitoring function is disabled by default. Before you start QT monitoring, enable the QT function. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the QT tab → select the Setup tab.
3. Switch on QT Analysis.

7.8.3 Displaying QT Numerics and Segments

To display QT numerics and Segments, follow this procedure:

1. Access Tile Layout by either of the following ways:
   - Select the Screen Setup quick key → select the Tile Layout tab.
   - Select Main Menu quick key → from the Display column select Tile Layout.
2. Click the parameter numeric area where you want to display the QT numerics, and then select ECG → QT/QTc.
NOTE

- QTc values are calculated based on the QT-HR, not the ECG HR. For more information, see 7.8.4 Entering the QT View.

The following picture shows the QT numeric area. The monitor screen may look slightly different:

(1) QTc alarm limit (if QTc alarm is off, the alarm off symbol is displayed)
(2) Parameter label
(3) QTc value
(4) ΔQTc value (the difference between the current and baseline QTc values)
(5) QT value
(6) QT-HR value

7.8.4 Entering the QT View

QT View shows the current and baseline QT parameter values and waveforms. To enter QT View, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the QT tab.
3. Select QT View.

The following picture shows a typical QT view.

- The current waveform is shown in the upper half in green.
- The baseline waveform is shown below in white.
- The waveform of selected lead is highlighted, while the waveforms of other leads are in light green or light gray.
- The start of the QRS complex and the end of the T wave are marked with a vertical line.
- In some conditions, no QT measurement can be made. Then the cause of failed QT measurement is shown at the bottom of the QT numerics area and the message “Cannot Analyze QT” is shown in the technical alarm area.

Select the left or right arrow to switch leads, and the corresponding waveform will be highlighted.
7.8.5 Saving the Current QTc as Baseline

In order to quantify changes in the QTc value, you can set a QTc baseline. If no baseline has been set for this patient within the first five minutes after getting valid QT values, the monitor will automatically set a baseline. To set the current values as baseline, follow this procedure:

1. From the QT View, select Set Baseline.
2. From the pop-up dialog box, select OK. This baseline will then be used to calculate ΔQTc.

If you set a new baseline the previous baseline is discarded.

From the QT View, you can also perform the following operations:

- Select the left or right arrow to select a lead label to highlight corresponding waveform.
- Select Display Baseline or Hide Baseline to display or hide the baseline waveform.

**CAUTION**

- Updating QTc baseline affects the ΔQTc value and alarm.

7.8.6 Changing QT Settings

7.8.6.1 Setting QT Alarm Properties

To set QT alarm properties, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the QT tab → select the Alarm tab.
3. Set QTc and ΔQTc alarm properties.

7.8.6.2 Selecting Leads for QT Calculation

You can select one lead or all leads for QT calculation. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the QT tab → select the Setup tab.
3. Set QT Leads. All is selected by default. This means all leads are used for QT calculation.

7.9 ECG Relearning

Changes in ECG beat morphology could result in incorrect arrhythmia alarms and/or inaccurate heart rate. ECG relearning allows the monitor to learn the new dominant beat morphology and thus reduce false arrhythmia alarms and inaccurate HR values. Once learning is complete, the dominant QRS complex is stored as a reference template. The reference template is used as the normal morphology of that patient and it is compared with incoming beats to identify possible arrhythmias.

7.9.1 Auto ECG Relearning

Auto arrhythmia relearning happens in the following situation:

- The ECG lead type or lead label is changed.
- ECG leads are off and are not reconnected within 60 seconds.
- The patient's paced status is changed.

7.9.2 Initiating an ECG Relearning Manually

If you suspect that false arrhythmia alarms are presented, you may need to manually initiate an ECG relearn. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select Relearn.

**CAUTION**

- Initiate ECG relearning only during periods of predominantly normal rhythm and when the ECG signal is relatively noise-free. If ECG learning takes place during arrhythmias, the ectopic beats may be incorrectly learned as normal QRS complexes. This may result in missed detection of subsequent arrhythmia events.

### 7.10 Defibrillation Synchronization Pulse Output

The 12-lead N1 provides an analog out connector to output synchronization pulses for defibrillators. If a defibrillator is connected, it receives a synchronization pulse (100 ms, +5 V) through the analog out connector each time an R-wave is detected. The 3/5/6 lead N1 monitor does not offer this output.

**WARNING**

- According to IEC 60601-2-4: 2010, the peak of the synchronized defibrillator discharge should be delivered within 60 ms of the peak of the R wave. The signal at the ECG output (sync pulse) on the monitor is delayed by maximum of 30 ms. The biomedical engineer should verify that the ECG/Defibrillator combination does not exceed recommended maximum delay of 60 ms.
- Before defibrillation, ensure that both defibrillator and monitor have passed the system test and can be safely used together.

### 7.11 ECG Troubleshooting

This section lists some of the problems that might be encountered during ECG monitoring. If you encounter problems when using the monitor or accessories, check the table below before requesting for services. If the problem persists after you have taken corrective actions, contact the service personnel.

**NOTE**

- For the physiological and technical alarm messages, see Appendix D Alarm Messages.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Corrective Actions</th>
</tr>
</thead>
</table>
| Noisy ECG traces              | 1. Check that the electrodes are not detached or dry. Replace with fresh and moist electrodes if necessary.  
2. Check that leadwires are not defective. Replace leadwires if necessary. 
3. Check that the patient cable or leadwires are not routed too close to other electrical devices. Move the patient cable or leadwires away from electrical devices and their cables if necessary. |
| Excessive electrosurgical Interference | Use ESU-proof ECG cables. For more information, see 25.1 ECG Accessories. |
| Muscle Noise                  | Inadequate skin preparation, tremors, tense subject, and/or poor electrode placement. 
1. Perform skin preparation again and re-place the electrodes. For more information, see 7.4.1 Preparing the Patient Skin and 7.4.2 Applying Electrodes and Connecting the Patient. 
2. Apply fresh, moist electrodes. Avoid muscular areas. |
| Intermittent Signal           | 1. Check that cables are properly connected.  
2. Check that electrodes are not detached or dry. Perform skin preparation again as described in 7.4.1 Preparing the Patient Skin and apply fresh and moist electrodes.  
3. Check that the patient cable or leadwires are not damaged. Change them if necessary. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Corrective Actions</th>
</tr>
</thead>
</table>
| Excessive alarms: heart rate, lead fault | 1. Check that electrodes are not dry. Perform skin preparation again and re-place the electrodes. For more information, see 7.4.1 Preparing the Patient Skin and 7.4.2 Applying Electrodes and Connecting the Patient.  
2. Check for excessive patient movement or muscle tremor. Reposition the electrodes. Replace with fresh and moist electrodes if necessary. |
| Low Amplitude ECG Signal               | 1. Check that the ECG gain is not set too low. Adjust the gain as required. For more information, see 7.5.3.2 Changing ECG Waveform Size.  
2. Perform skin preparation again and re-place the electrodes. For more information, see 7.4.1 Preparing the Patient Skin and 7.4.2 Applying Electrodes and Connecting the Patient.  
3. Check electrode application sites. Avoid bone or muscular area.  
4. Check that electrodes are not dry or used for a prolonged time. Replace with fresh and moist electrodes if necessary. |
| No ECG Waveform                        | 1. Check that the ECG gain is not set too low. Adjust the gain as required. For more information, see 7.5.3 Changing ECG Wave Settings.  
2. Check that the leadwires and patient cables are properly connected.  
3. Change cable and lead wires if necessary.  
4. Check that the patient cable or leadwires are not damaged. Change them if necessary. |
2. Check that electrodes are not detached or dry and replace with fresh and moist electrodes if necessary. For more information, see 7.4.1 Preparing the Patient Skin and 7.4.2 Applying Electrodes and Connecting the Patient.  
3. Check for ECG filter setting. Set ECG Filter mode to Monitor to reduce baseline wander on the display. |
8 Resting 12-Lead ECG Analysis

8.1 Resting 12-Lead ECG Analysis Introduction
The monitor can be configured with the Glasgow 12-lead resting ECG analysis algorithm. The monitor incorporating the Glasgow algorithm is labeled with the logo of Glasgow as shown in 7.1 ECG Introduction.
The Glasgow algorithm is intended for adult, pediatric, and neonatal patients.

8.2 Entering the 12-Lead Screen
To enter the 12-Lead screen, follow this procedure:
1. Select the ECG numeric area or waveform area to enter the ECG dialog.
2. From the bottom of the ECG dialog, select 12-Lead.
You can also enter the 12-Lead screen by following this procedure:
- Select the Screen Setup quick key → select Choose Screen → select ECG 12-Lead.
- Select Main Menu quick key → from the Display column select Choose Screen → select ECG 12-Lead.

NOTE
• The ECG 12-Lead screen is available only when the Glasgow algorithm is configured (associated module has the Glasgow label) and Lead Set is set to Auto or 12-Lead.

8.3 Initiating Resting 12-Lead ECG Analysis
Before initiating 12-lead ECG analysis, check that all electrodes are correctly connected to the lead wires and the ECG trunk cable is properly connected. Check that patient information is correct. Keep the patient still.
To initiate 12-Lead ECG analysis, select Analyze from the bottom left of the 12-Lead screen.

8.4 Changing 12-Lead ECG Analysis Settings
On the ECG 12-Lead screen, you can set the high frequency filter, baseline drift removal (BDR) filter, and the waveform layout.

8.4.1 Setting the High Frequency Filter
The high frequency filter attenuates muscle artifact by restricting the included frequencies. The setting of the high frequency filter is 35 Hz by default. To change the setting, follow this procedure:
1. On the ECG 12-Lead screen, select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Set High-Freq Cut-off.
The high frequency filter is a low-pass filter. That is to say, signal frequencies higher than the set frequency are filtered out. For example, if you set High-freq Cutoff to 35 Hz, then signal below 35 Hz is kept in the signal and signal exceeding 35 Hz is attenuated.

8.4.2 Setting the Baseline Drift Removal Filter
The baseline drift removal (BDR) filter suppresses most baseline drift interference and also is able to preserve the fidelity of the ST-segment level. BDR is switched on by default. To set the BDR, follow this procedure:
1. On the ECG 12-Lead screen, select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Switch on or off Baseline Drift Removal as desired. If BDR is switched off, the 0.05 Hz high pass filter is used.

**NOTE**
- BDR introduces around 1-second delay. Using BDR is recommended except when the delay is unacceptable.

### 8.4.3 Setting the 12-Lead Waveform Layout

To set the 12-lead waveform layout, follow this procedure:

1. On the ECG 12-Lead screen, select the ECG numeric area or waveform area to enter the ECG dialog.
2. Select the Setup tab.
3. Set Waveform Layout.

  - **Standard**: the waveform sequence is I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6.
  - **Cabrera**: the waveform sequence is aVL, I, -aVR, II, aVF, III, V1, V2, V3, V4, V5, V6.

For the Glasgow algorithm, the sequence of the chest leads depends on the setting of V3 placement. If V3 placement is set to V4R, the sequence of chest leads is V4R, V1, V2, V4, V5, V6.

### 8.4.4 Editing Patient Information

Some patient information may directly affect ECG analysis. Complete and correct patient information is helpful for accurate diagnosis and treatment of the patient. Enter patient information before starting a resting ECG analysis.

To enter patient information, follow this procedure:

1. On the ECG 12-Lead screen, select Setup to enter the 12-Lead Setup dialog.
2. On the Patient Demographics page, input or edit patient information.

**NOTE**
- Saving information will also save the information as though it was entered in the Patient Management dialog.
- Changes are not saved until you press Save. So changing to another tab without saving and then pressing the exit button “X” will lose any changes.
- Check that patient information is correct before starting a resting 12-lead analysis.
- Using pediatric lead placement V4R, V1, V2, V4 - V6 is recommended if the patient is under 16 years of age. Please record V4R using the V3 electrode. Also set V3 Electrode to V4R. This is a normal practice for a patient of this age.

### 8.4.5 Setting Tachycardia and Bradycardia Thresholds

To set tachycardia and bradycardia thresholds, follow this procedure:

1. On the ECG 12-Lead screen, select Setup to enter the 12-Lead Setup dialog.
2. Select the Setup tab.
3. Set Tachy and Brady.

**NOTE**
- The tachycardia threshold only applies to patients whose age exceeds 180 days.
- The bradycardia threshold only applies to patients whose age exceeds 2191 days (6 years).
8.4.6  Setting the 12-Lead Interpretation Report
To set the 12-lead interpretation report, follow this procedure:
1. On the ECG 12-Lead screen, select Setup to enter the 12-Lead Setup dialog.
2. Select the Report tab.
3. Set the format and items included in the 12-lead interpretation report.

8.5  Saving the 12-Lead Interpretation Report
At the completion of 12-lead ECG interpretation, select Save to save the report. You can review the saved 12-lead interpretation reports. For more information, see 15.2.10 12-Lead ECG Review Page.

8.6  Printing the 12-Lead Interpretation Report
At the completion of 12-lead ECG interpretation, select Print to output the report via printer.

8.7  Exiting the ECG 12-Lead Screen
To exit the ECG 12-Lead screen, select Exit on the ECG 12-Lead screen.
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9 Monitoring Impedance Respiration (Resp)

9.1 Resp Introduction

Impedance respiration is measured across the thorax. When the patient is breathing or ventilated, the volume of air changes in the lungs, resulting in impedance changes between the electrodes. Impedance respiration rate (RR) is calculated from the signal representing these impedance changes, and a respiration waveform is displayed on the patient monitor screen.

Impedance respiration monitoring is intended for adult, pediatric and neonatal patients.

Respiration may also be measured using a CO2 module. Refer to 14 Monitoring Carbon Dioxide (CO2) for respiration information specific to the CO2 module.

9.2 Impedance Resp Safety Information

WARNING

• When monitoring the patient’s impedance respiration, do not use ESU-proof ECG cables. The monitor cannot measure impedance respiration with ESU-proof ECG cables.

• If you do not set the detection level for the respiration correctly in manual detection mode, it may not be possible for the monitor to detect zero respiration rate. If you set the detection level too low, the monitor is more likely to detect cardiac activity, and to falsely interpret cardiac activity as respiratory activity in case of zero respiration rate.

• The respiration measurement does not recognize the cause of zero respiration rates. It only indicates an alarm if a pre-adjusted time has elapsed without a breath being detected since the last detected breath. Therefore, it cannot be used for diagnostic purpose.

• If operating under conditions according to the EMC Standard IEC 60601-1-2 (Radiated Immunity 3V/m), field strengths above 3V/m may cause erroneous measurements at various frequencies. Therefore, it is recommended to avoid the use of electrically radiating equipment in close proximity to the impedance respiration measurement unit.

• The current used to measure impedance respiration may cause rate changes in Minute Ventilation Rate Responsive Pacemakers. If you suspect the patient monitor is affecting the pacemaker rate then replace the ECG cable with an ECG cable that contains ESU filters.

CAUTION

• Only use parts and accessories specified in this manual.

• Impedance respiration monitoring is not for use on patients while they are active, as this can cause false alarms.
9.3 Resp Display

![Resp Waveform Diagram]

- (1) Resp waveform gain
- (2) Resp lead label
- (3) Alarm limits
- (4) Respiration rate (RR)
- (5) RR source

**NOTE**

- If ESU-proof ECG cables are used, the Resp waveform area will display the message “Check Leads”. Replace the ECG cable if necessary.

9.4 Preparing for Impedance Resp Monitoring

9.4.1 Preparing the Patient

Follow this procedure to prepare the patient:

1. Shave hair from skin at chosen sites.
2. Gently rub skin surface at sites to remove dead skin cells.
3. Thoroughly cleanse the site with a mild soap and water solution.
4. Dry the skin completely before applying the electrodes.

**CAUTION**

- Proper skin preparation is necessary for good signal quality at the electrode site, as the skin is a poor conductor of electricity.
9.4.2 Placing the Electrodes

Impedance respiration is acquired using standard ECG electrodes and cables. Either lead I (RA-LA) or lead II (RA-LL) can be used.

For more information, see 7.4.4 ECG Electrode Placements.

CAUTION

- Correct electrode placement can help to reduce interference from cardiac related impedance changes: avoid including the liver area and the ventricles of the heart between the respiratory electrodes. This is particularly important for neonates.
- Some patients with restricted movements breathe mainly abdominally. In these cases, you may need to place the left leg electrode on the left abdomen at the point of maximum abdominal expansion to optimize the respiratory waveform.
- Some patients (especially neonates) expand their chests laterally, causing a negative intrathoracic pressure. In these cases, it is better to place the two respiration electrodes in the right midaxillary and the left lateral chest areas at the patient's maximum point of the breathing movement to optimize the impedance respiration waveform.
- To optimize the impedance respiration waveform, place the RA and LA electrodes horizontally when monitoring respiration with ECG Lead I; place the RA and LL electrodes diagonally when monitoring respiration with ECG Lead II.
- Periodically inspect electrode application sites to ensure skin integrity. If the skin quality changes, replace the electrodes or change the application site.

NOTE

- Store the electrodes at room temperature. Open the electrode package immediately prior to use.
- Check that the electrode packages are intact and that the electrodes are not past the expiration date. Ensure the electrode gel is moist.
9.5 Changing Resp Settings

9.5.1 Setting the Resp Alarm Properties
To set the Resp alarm properties, follow this procedure:
1. Select the Resp numeric area or waveform area to enter the Resp dialog.
2. Select the Alarm tab.
3. Enter the password if required. For more information, refer to 21.12.3 Selecting Password for User Authentication.
4. Set alarm properties as desired.

9.5.2 Setting the RR Source
To set RR source, follow this procedure:
1. Select the Resp numeric area or waveform area to enter the Resp dialog.
2. Select the Setup tab.
3. Choose RR Source from the dropdown list.
   When you select Auto, the monitor automatically selects the RR source following order of priority: first CO2, and then ECG. When the manually selected RR source is not available, the monitor automatically switches the RR Source to Auto.

9.5.3 Choosing the Respiration Lead
To set the respiration lead, follow this procedure:
1. Select the Resp numeric area or waveform area to enter the Resp dialog.
2. Select the Setup tab.
   If you cannot get an acceptable impedance Resp waveform or you suspect the veracity of the Resp value after choosing the Resp lead, you may need to adjust the electrode placement.

9.5.4 Setting the Resp Waveform Size
To set the Resp waveform size, follow this procedure:
1. Select the Resp numeric area or waveform area to enter the Resp dialog.
2. Select the Setup tab.
3. Set Gain.

9.5.5 Setting the Resp Waveform Speed
To set the Resp waveform speed, follow this procedure:
1. Select the Resp numeric area or waveform area to enter the Resp dialog.
2. Select the Setup tab.
3. Set Speed.
9.5.6 Setting the Auto Detection Switch

To set the auto detection switch, follow this procedure:

1. Select the Resp numeric area or waveform area to enter the Resp dialog.
2. Select the Setup tab.
3. Switch on or off Auto Threshold Detection.
   - If Auto Threshold Detection is switched on, the monitor automatically adjusts the Resp waveform detection level, or threshold.
   - If Auto Threshold Detection is switched off, you have to manually adjust the Resp waveform threshold. For more information, see 9.5.7 Adjusting the Resp Waveform Detection Threshold.

In the auto threshold detection mode, if you are monitoring Resp and the ECG parameter is switched off, the monitor cannot compare the heart rate and Resp rates to detect cardiovascular artifact. The respiration detection level is automatically set higher to prevent the detection of cardiovascular artifact as respiration.

In the manual detection mode (where auto threshold detection is off), cardiovascular artifact can, in certain situations, trigger the respiration rate counter. This may lead to a false indication of a high respiration or an undetected zero respiration rate condition. If you suspect that cardiovascular artifact is being registered as respiratory activity, raise the detection level above the zone of cardiovascular artifact. If the Resp wave is so small that raising the detection level is not possible, you may need to optimize the electrode placement.

9.5.7 Adjusting the Resp Waveform Detection Threshold

Use the manual detection mode (where auto threshold detection is off) in the following situations:

- The respiration rate and the heart rate are close.
- Patients have intermittent mandatory ventilation.
- Respiration is weak. Try repositioning the electrodes to improve the signal.

To set the Resp waveform threshold to the desired level, follow this procedure:

1. Select the Resp numeric area or waveform area to enter the Resp dialog.
2. Select the Threshold tab.
3. Select the up and down arrows below Upper Line and Lower Line to define the Resp waveform threshold.

Once set, the detection level will not adapt automatically to different respiration depths. It is important to remember that if the depth of breathing changes, you may need to change the detection level.
10 Monitoring Pulse Oxygen Saturation (SpO₂)

10.1 SpO₂ Introduction

Pulse Oxygen Saturation (SpO₂) monitoring is a non-invasive technique used to measure the amount of oxygenated hemoglobin and pulse rate by measuring the absorption of selected wavelengths of light. The light generated in the emitter side of the probe is partly absorbed when it passes through the monitored tissue. The amount of transmitted light is detected in the detector side of the probe. When the pulsative part of the light signal is examined, the amount of light absorbed by the hemoglobin is measured and the pulse oxygen saturation can be calculated. This device is calibrated to display functional oxygen saturation.

SpO₂ monitoring is intended for adult, pediatric and neonatal patients.

The monitor can be configured for the N1 monitor:

- Masimo SpO₂: the connector is purple and the logo of Masimo SET is on the monitor.
- Nellcor SpO₂: the connector is grey and the logo of Nellcor is on the monitor.

NOTE

- The SpO₂ extension cable used must be compatible with the SpO₂ sensor connectors used. For example, only the Masimo SpO₂ extension cable can be connected to the Masimo SpO₂ sensor connectors.
- A functional tester or SpO₂ simulator can be used to determine the pulse rate accuracy.
- A functional tester or SpO₂ simulator cannot be used to assess the SpO₂ accuracy.

10.2 SpO₂ Safety Information

WARNING

- When a trend toward patient deoxygenation is indicated, analyze the blood samples with a laboratory co-oximeter to completely understand the patient’s condition.
- Do not use SpO₂ sensors during magnetic resonance imaging (MRI). Induced current could potentially causes burns. The sensor may affect the MRI image, and the MRI unit may affect the accuracy of the oximetry measurements.
- Prolonged continuous monitoring may increase the risk of undesirable changes in skin characteristics, such as irritation, reddening, blistering or burns. Inspect the sensor site every two hours and move the sensor if the skin quality changes. Change the application site every four hours. For neonates, or patients with poor peripheral blood circulation or sensitive skin, inspect the sensor site more frequently.
- If the sensor is too tight because the application site is too large or becomes too large due to edema, excessive pressure for prolonged periods may result in venous congestion distal from the application site, leading to interstitial edema and tissue ischemia.
- When patients are undergoing photodynamic therapy they may be sensitive to light sources. Pulse oximetry may be used only under careful clinical supervision for short time periods to minimize interference with photodynamic therapy.
- Setting alarm limits to extreme values may cause the alarm system to become ineffective. For example, high oxygen levels may predispose a premature infant to retrolental fibroplasia. If this is a consideration, do not set the high alarm limit to 100%, which is equivalent to switching off the alarm.
- SpO₂ is empirically calibrated in healthy adult volunteers with normal levels of carboxyhemoglobin (COHb) and methemoglobin (MetHb).
10.3 SpO₂ Measurement Limitations

The following factors may influence the accuracy of SpO₂ measurement:

- **Patient physiological characteristics:**
  - Cardiac arrest
  - Hypotension
  - Darkly pigmented skin
  - Shock
  - Severe vasoconstriction
  - Hypothermia
  - Severe anemia
  - Ventricular septal defects (VSDs)
  - Venous pulsations
  - Poor perfusion
  - Dysfunctional hemoglobin, such as carboxyhemoglobin (COHb) and methemoglobin (MetHb)
  - Elevated levels of bilirubin
  - Vasospastic disease, such as Raynaud’s, and peripheral vascular disease
  - Hemoglobinopathies and synthesis disorders such as thalassemias, Hb s, Hb c, sickle cell, etc.
  - Hypocapnic or hypercapnic conditions
  - Birthmark(s), tattoos, skin discolorations, moisture on skin, deformed or abnormal fingers, etc.

- **Interfering substances:**
  - Intravascular dyes (such as indocyanine green, methylene blue, indigo carmine, etc.)
  - Dyes in the measure site, such as nail polish

- **Environmental conditions:**
  - Excessive ambient light
  - Electrosurgery equipment
10.4 SpO₂ Display

(1) Pleth waveform (Pleth): visual indication of patient's pulse. The waveform is not normalized.
(2) Oxygen saturation of arterial blood (SpO₂): percentage of oxygenated hemoglobin in relation to the sum of oxyhemoglobin and deoxyhemoglobin.
(3) Perfusion indicator: the pulsatile portion of the measured signal caused by arterial pulsation.
(4) Pulse rate (derived from the pleth waveform): detected pulsations per minute.
(5) Perfusion index (PI): gives the numerical value for the pulsatile portion of the measured signal caused by arterial pulsation. PI is an indicator of the pulsatile strength. You can also use it to assess the SpO₂ signal strength.

- Above 1 is optimal.
- Between 0.3 and 1 is acceptable.
- Below 0.3 indicates low perfusion. Set Sensitivity to Maximum first. Reposition the SpO₂ sensor or find a better site. If low perfusion persists, choose another method to measure oxygen saturation if possible.

NOTE
- PI is displayed for Masimo SpO₂.

10.5 Preparing for SpO₂ Monitoring

To prepare to monitor SpO₂, follow this procedure:

1. Select an appropriate sensor according to the module type, patient category and weight.
2. Clean the contact surface of the reusable sensor.
3. Remove colored nail polish from the application site.
4. Apply the sensor to the patient according to the instruction for use of the sensor.
5. Select an appropriate extension cable according to the connector type and plug the cable into the SpO₂ connector.
6. Connect the sensor to the extension cable.

CAUTION
- Do not apply sensor too tightly as this results in venous pulsation which may severely obstruct circulation and lead to inaccurate measurements.
• At elevated ambient temperatures, be careful with measurement sites that are not well perfused, because this can cause burns after prolonged application.
• Avoid placing the sensor on extremities with an arterial catheter, an NIBP cuff or an intravascular venous infusion line.
• For neonatal patients, make sure that all sensor connectors and adapter cable connectors are outside the incubator. The humid atmosphere inside can cause inaccurate measurements.

10.6 Changing the SpO₂ Settings

10.6.1 Changing the SpO₂ Alarm Settings

To change the SpO₂ alarm settings, follow this procedure:
1. Select the SpO₂ numeric area or waveform area to enter the SpO₂ dialog.
2. Select the Alarm tab.
3. Enter the password if required. For more information, refer to 21.12.3 Selecting Password for User Authentication.
4. Set the alarm properties as desired.

NOTE
• The desat alarm is a high level alarm notifying you of potentially life threatening drops in oxygen saturation. When the SpO₂ value is below the desat alarm limit and desat alarm switch is set on, the message “SpO₂ Desat” is displayed.
• You can switch off the SpO₂ Desat alarm only when the SpO₂ Desat Alarm Off is enabled. For more information, see section 21.3.6.6 Setting the Switch of the SpO₂ Desat Alarm Off.

10.6.2 Nellcor SatSeconds™ Alarm Management

With traditional alarm management, high and low alarm limits are set for monitoring oxygen saturation. During monitoring, once an alarm limit is violated, an audible alarm immediately sounds. When the patient SpO₂ fluctuates near an alarm limit, the alarm sounds each time the limit is violated. Such frequent alarms can be distracting. Nellcor’s SatSeconds alarm management technique is used to reduce these nuisance alarms.

The SatSeconds feature is available with the Nellcor SpO₂ to decrease the likelihood of false alarms caused by motion artifacts. With SatSeconds alarm management, high and low alarm limits are set in the same way as those with traditional alarm management. A SatSeconds limit is also set. The SatSeconds limit controls the amount of time that SpO₂ saturation may be outside the set limits before an alarm sounds.

The method of calculation is as follows: the percentage points of the SpO₂ saturation falling outside the alarm limit is multiplied by the number of seconds remaining outside the limit. This can be stated as the equation:

\[ \text{SatSeconds} = \text{Points} \times \text{Seconds} \]

Only when the SatSeconds limit is reached, the monitor gives a SatSeconds alarm. For example, the figure below demonstrates the alarm response time with a SatSeconds limit set at 50 and a low SpO₂ limit set at 90%. In this example, the patient SpO₂ drops to 88% (2 points) and remains there for 2 seconds. Then it drops to 86% (4 points) for 3 seconds, and then to 84% (6 points) for 6 seconds. The resulting SatSeconds are:

<table>
<thead>
<tr>
<th>% SpO₂</th>
<th>Seconds</th>
<th>SatSeconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2×</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4×</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>6×</td>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>Total SatSeconds=</td>
<td></td>
<td>52</td>
</tr>
</tbody>
</table>

After approximately 11 seconds, a Sat-Second alarm would sound, because the limit of 50 SatSeconds would have been exceeded.
Saturation levels may fluctuate rather than remaining steady for a period of several seconds. Often, the patient SpO2 may fluctuate above and below an alarm limit, re-entering the non-alarm range several times. During such fluctuation, the monitor integrates the number of SpO2 points, both positive and negative, until either the SatSeconds limit is reached, or the patient SpO2 re-enters the non-alarm range and remains there.

NOTE

- The SpO2 Too Low or SpO2 Too High alarm is presented in the case that SpO2 value violates the alarm limits 3 times within one minute even if the setting of SatSeconds is not reached.

To set the SatSeconds, follow this procedure:
1. Select the SpO2 numeric area or waveform area to enter the SpO2 dialog.
2. Select the Alarm tab.
3. Set Sat-Seconds.

10.6.3 Setting SpO2 Sensitivity (for Masimo SpO2)

For Masimo SpO2, you can set Sensitivity to Normal, Maximum, or APOD.

Normal sensitivity is the recommended for patients who are experiencing some compromise in blood flow or perfusion. It is advisable for care areas where patients are observed frequently, such as the intensive care unit (ICU).

Adaptive Probe Off Detection (APOD) sensitivity is the recommended sensitivity mode where there is a high probability of the sensor becoming detached. It is also the suggested mode for care areas where patients are not visually monitored continuously. This mode delivers enhanced protection against erroneous pulse rate and arterial oxygen saturation readings when a sensor becomes inadvertently detached from a patient due to excessive movement.

Maximum sensitivity is recommended for use on patients with weak signals (e.g. high ambient noise and/or patients with very low perfusion) and for use during procedures or when clinician and patient contact is continuous such as in higher acuity settings. The settings of sensitivity in the SpO2 module and SpO2b module are linked.

To set SpO2 sensitivity, follow this procedure:
1. Select the SpO2 numeric area or waveform area to enter the SpO2 dialog.
2. Select the SpO2 Setup tab.
3. Set Sensitivity to Maximum, Normal, or APOD.
10.6.4 Changing Averaging Time (for Masimo SpO2)

The SpO2 value displayed on the monitor screen is the average of data collected within a specific time. The shorter the averaging time is, the quicker the monitor responds to changes in the patient’s oxygen saturation level. Contrarily, the longer the averaging time is, the slower the monitor responds to changes in the patient’s oxygen saturation level, but the SpO2 measurement is more stable. For critically ill patients, selecting a shorter averaging time will help with understanding the patient’s state.

To set the averaging time, follow this procedure:
1. Select the SpO2 numeric area or waveform area to enter the SpO2 dialog.
2. Select the SpO2 Setup tab.
3. Set Averaging.

10.6.5 Monitoring SpO2 and NIBP Simultaneously

When monitoring SpO2 and NIBP on the same limb simultaneously, you can switch on NIBP Simul to lock the SpO2 alarm status until the NIBP measurement ends. If you switch off NIBP Simul, low perfusion caused by NIBP measurement may lead to inaccurate SpO2 readings and therefore cause false physiological alarms.

To set the NIBP Simul, follow this procedure:
1. Select the SpO2 numeric area or waveform area to enter the SpO2 dialog.
2. Select the Alarm tab.
3. Set NIBP Simul.

10.6.6 Changing the Sweep Speed of the Pleth Waveform

To set the sweep speed of Pleth waveforms, follow this procedure:
1. Select the SpO2 numeric area or waveform area to enter the SpO2 dialog.
2. Select the SpO2 Setup tab.
3. Set Speed.

10.7 Changing the PR Settings

10.7.1 Changing the PR Alarm Settings

To change the PR alarm settings, follow this procedure:
1. Select the SpO2 numeric area or waveform area to enter the SpO2 dialog.
2. Select the PR Alarm tab.
3. Enter the password if required. For more information refer to 21.12.3 Selecting Password for User Authentication.
4. Set the alarm properties as desired.

10.7.2 Changing the QRS Volume

If the Alarm Source is set to PR, the QRS tone is derived from PR measurements. To set the QRS volume, follow this procedure:
1. Select the SpO2 numeric area or waveform area to enter the SpO2 dialog.
2. Select the PR Setup tab.
3. Set QRS Volume.

If the SpO₂ value is valid, the monitor also adjusts the QRS tone (pitch tone) according to the SpO₂ value. For information, see 21.16.3 Setting the SpO₂ Tone Mode.

**NOTE**
- Changing the QRS volume settings in the PR Setup page also changes the QRS volume settings in the Setup page of the ECG dialog.

### 10.7.3 Setting the PR Source

Current pulse source is displayed in the PR numeric area if current PR source is not SpO₂. The PR from current pulse source has the following characteristics:

- PR is stored in the monitor's database and can be reviewed in the graphic and tabular trends. In graphic trends, as the PR curve has the same color as that of current PR source.
- PR is sent via the network to the CMS, if available.

To set which parameter is used as a PR source, follow this procedure:
1. Select the SpO₂ numeric area or waveform area to enter the SpO₂ dialog.
2. Select the PR Setup tab.
3. Set PR Source.

The dropdown list of the PR Source displays the currently available PR sources from top to bottom by priority. When you select Auto, the system will automatically select the first option as the PR source. If the current PR source is unavailable, the system will automatically switch PR Source to Auto. When you select IBP, the system will automatically select the first pressure label as the PR source.

### 10.7.4 Showing/Hiding PR

You can set whether to display the PR value in the SpO₂ parameter area. To do so, follow this procedure:
1. Select the SpO₂ numeric area or waveform area to enter the SpO₂ menu.
2. Select the PR tab.
3. Select the Setup tab.
4. Switch on or off Display PR.

### 10.8 SpO₂ Troubleshooting

This section lists the problems that might occur. If you encounter the problems when using the equipment or accessories, check the table below before requesting service. If the problem persists, contact your service personnel.

**NOTE**
- For the physiological and technical alarm messages, see Appendix D Alarm Messages.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
</table>
| Do not see SpO₂ numeric area or waveform area on the main screen | 1. Check that the SpO₂ is set to display in the Screen Setup → → Tile Layout page. For more information, see 3.11.2 Displaying Parameter Numerics and Waveforms.  
2. Check that the SpO₂ parameter switch is enabled. If not, enable the SpO₂ measurement. For more information, see 3.11.1 Switching On or Off a Parameter.  
3. Check that the cable connections of the SpO₂ sensor and the extension cable are tight. Replace the SpO₂ sensor or the extension cable if needed. |
10.9 Masimo Information

Masimo Patents

This posting serves as notice under 35 U.S.C.§287(a) for Masimo patents: http://www.masimo.com/patents.htm.

No Implied License

Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized sensors or cables which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

10.10 Nellcor Information

Nellcor Patents

This posting serves as notice under 35 U.S.C.§287(a) for Covidien patents: http://www.covidien.com/patents.htm.

No Implied License

Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized replacement parts which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
</table>
| Dashes "- -" display in place of numerics | 1. Check that the cable connections of SpO₂ sensor and the extension cable are tight. Replace the SpO₂ sensor or the extension cable if needed.  
2. Reconnect the SpO₂ sensor if the alarm SpO₂ Sensor Off appears.  
3. Check the PI value. If the PI value is too low, adjust the SpO₂ sensor, or apply the sensor to a site with better perfusion.  
4. Move the sensor to a place with weaker ambient light, or cover the sensor to minimize the ambient light if the alarm SpO₂ Too Much Light appears. |
| Low amplitude SpO₂ signal | 1. The SpO₂ sensor and NIBP cuff are placed on the same limb. Change the monitoring site if necessary.  
2. Check the PI value. If the PI value is too low. Adjust the SpO₂ sensor, or apply the sensor to a site with better perfusion. |
| SpO₂ value is inaccurate | 1. Check the patient's vital signs.  
2. Check for conditions that may cause inaccurate SpO₂ readings. For more information, see 10.3 SpO₂ Measurement Limitations.  
3. Check the monitor and the SpO₂ sensor for proper functioning. |
11 Monitoring Temperature (Temp)

11.1 Temperature Introduction

The monitor can continuously monitor the patient’s skin temperature and core temperature. Thermally sensitive resistors (thermistors) are used, and are based on the principle that electrical resistance of the thermistor changes as temperature changes. The resistance change of the thermistors is used to calculate the temperature.

Up to two temperature sites can be monitored simultaneously and the difference between two measured sites is calculated.

Temperature monitoring is intended for adult, pediatric and neonatal patients.

11.2 Temperature Safety Information

**CAUTION**

• Verify that the probe detection program works correctly before monitoring. Remove the temperature probe cable from the temperature probe connector, and check that the monitor can display the alarm messages and give alarm tones correctly.

11.3 Temperature Display

The following figure shows the Temp numeric area for temperature monitoring with the monitor. Your display may be configured to look different.

![Temperature Display Diagram]

(1) Temperature site  (2) Temperature alarm limits  (3) Temperature value

(4) Temperature difference ($\Delta$T): Difference between two temperature sites. It displays only when $\Delta$T is switched on.

11.4 Preparing for Temperature Monitoring

To prepare temperature monitoring, follow this procedure:

1. Select an appropriate probe for your patient according to patient category and measured site.
2. Plug the probe or temperature cable to the temperature connector. If using a disposable probe, connect the probe to the temperature cable.
3. Follow the probe manufacturer’s instructions to connect the probe to the patient.
11.5 Changing Temperature Settings

11.5.1 Setting the Temperature Alarm Properties
To set the temperature alarm properties, follow this procedure:

1. Select the temperature numeric area to enter the Temp dialog.
2. Select the Alarm tab.
3. Enter the password if required. For more information, refer to 21.12.3 Selecting Password for User Authentication.
4. Set the alarm properties as desired.

11.5.2 Selecting the Temperature Label
Select the temperature label according to the measurement site. To do so, follow this procedure:

1. Select the temperature numeric area to enter the Temp dialog.
2. Select the Setup tab.
3. Set the temperature label.

<table>
<thead>
<tr>
<th>Label</th>
<th>Description</th>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Temperature of application site 1</td>
<td>T amb</td>
<td>Ambient temperature</td>
</tr>
<tr>
<td>T2</td>
<td>Temperature of application site 2</td>
<td>T airw</td>
<td>Airway temperature</td>
</tr>
<tr>
<td>T skin</td>
<td>Skin temperature</td>
<td>T vesic</td>
<td>Vesical temperature</td>
</tr>
<tr>
<td>T core</td>
<td>Core temperature</td>
<td>T blood</td>
<td>Blood temperature</td>
</tr>
<tr>
<td>T axil</td>
<td>Axillary temperature</td>
<td>T myo</td>
<td>Myocardial temperature</td>
</tr>
<tr>
<td>T naso</td>
<td>Nasopharyngeal temperature</td>
<td>T tymp</td>
<td>Tympanic temperature</td>
</tr>
<tr>
<td>T eso</td>
<td>Esophageal temperature</td>
<td>T cereb</td>
<td>Cerebral temperature</td>
</tr>
<tr>
<td>T rect</td>
<td>Rectal temperature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11.5.3 Displaying the Temperature Difference
To display the temperature difference between two measurement sites monitored by the same temperature module, switch on ΔT. To do so, follow this procedure:

1. Select the temperature numeric area to enter the Temp dialog.
2. Select the Setup tab.
3. Switch on ΔT.

11.6 Temperature Troubleshooting
This section lists the problems that might occur. If you encounter the problems when using the equipment or accessories, check the table below before requesting service. If the problem persists, contact your service personnel.

**NOTE**
- For the physiological and technical alarm messages, see Appendix D Alarm Messages.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
</table>
| Do not see Temp numeric area on the main screen | 1. Check that if the Temp parameter switch is enabled. If not, enable the Temp measurement. For more information, see 3.11.1 Switching On or Off a Parameter.  
2. Check that the connections of the temperature probe and the temperature cable are tight. |
| Measurement fails/‘--’ is displayed in the Temp numeric area | 1. If using a disposable probe, check the connection between the probe and the temperature cable.  
2. Try using a known good probe in case the sensor is damaged. |
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12 Monitoring Noninvasive Blood Pressure (NIBP)

12.1 NIBP Introduction

The monitor uses the oscillometric method for measuring Non-Invasive Blood Pressure (NIBP). NIBP measurement is based on the principle that pulsatile blood flow through an artery creates oscillations of the arterial wall. The oscillometric device uses a blood pressure cuff to sense these oscillations that appear as tiny pulsations in cuff pressure. The oscillometric devices measure the amplitude of pressure changes in the occluding cuff as the cuff deflates from above systolic pressure. The amplitude suddenly increases as the pulse breaks through the occlusion in the artery. As the cuff pressure decreases further, the pulsations increase in amplitude, reach a maximum (which approximates to the mean pressure), and then diminish. The oscillometric method measures the mean pressure and determines the systolic and diastolic pressures.

NIBP monitoring is intended for adult, pediatric, and neonatal patients.

NOTE

- Blood pressure measurements determined with this device are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultatory method or an intra-arterial blood pressure measurement device, within the limits prescribed by the American National Standard: manual, electronic, or automated sphygmomanometers.
- NIBP measurement can be performed during electro-surgery and discharge of a defibrillator.

12.2 NIBP Safety Information

WARNING

- Be sure to select the correct patient category setting for your patient before NIBP measurement. Do not apply the higher adult settings for pediatric or neonatal patients. Otherwise, it may present a safety hazard.
- Do not measure NIBP on patients with sickle-cell disease or on the limb where skin damage has occurred or is expected.
- Use clinical judgment to determine whether to perform frequent unattended blood pressure measurements on patients with severe blood clotting disorders because of the risk of hematoma in the limb fitted with the cuff.
- Do not use the NIBP cuff on a limb with an intravenous infusion or arterial catheter in place. This could cause tissue damage around the catheter when the infusion is slowed or blocked during cuff inflation.
- Do not apply cuff on the arm on the side of a mastectomy.
- Continuous cuff pressure due to connection tubing kinking may cause blood flow interference and result in harmful injury to the patient.
- NIBP reading can be affected by the measurement site, the position of the patient, exercise, or the patient's physiologic condition. If you doubt the NIBP measurements, determine the patient's vital signs by alternative means, and then verify that the monitor is working correctly.
- Devices that exert pressure on tissue have been associated with purpura, ischemia, and neuropathy. Inspect the application site regularly to ensure skin quality and inspect the extremity of the cuffed limb for normal color, warmth and sensitivity. If the skin quality changes, or if the extremity circulation is being affected, move the cuff to another site or stop the blood pressure measurements immediately. Check more frequently when making automatic or STAT measurements. Auto NIBP measurements with one and two minute intervals are not recommended for extended periods of time.
- Do not modify or replace connectors of the NIBP air hose except with mindray-approved connectors. Use neonatal and infant cuffs with CM1901 hoses only. Use pediatric/adult cuffs with CM1903 hoses only.
• Never connect intra-arterial or intra-venous lines, or any other incompatible connectors to the NIBP hose. This can cause serious injury or death.
• NIBP diagnostic significance must be decided by the hospital’s clinician staff.

CAUTION
• Only use parts and accessories specified in this manual. Follow the instructions for use and adhere to all warnings and cautions.
• Accuracy of NIBP measurement depends on using a cuff of proper size. It is essential to measure limb circumference and choose a cuff with proper size.

12.3 NIBP Measurement Limitations
Measurements are impossible with heart rate extremes of less than 30 bpm or greater than 300 bpm, or if the patient is on a heart-lung machine. The measurement may be inaccurate or impossible in the following situations:
■ Regular arterial pressure pulses are hard to detect
■ Excessive and continuous patient movement such as shivering or convulsions
■ Cardiac arrhythmias
■ Rapid blood pressure changes
■ Severe shock or hypothermia that reduces blood flow to the peripheries
■ On an edematous extremity
■ Obesity, where a thick layer of fat surrounding a limb dampens the oscillations coming from the artery

NOTE
• The effectiveness of this sphygmomanometer has not been established in pregnant women, including pre-eclamptic patients.

12.4 Measurement Modes
There are three NIBP measurement modes:
■ Manual: measurement on demand.
■ Auto: repeated measurements at set interval.
■ STAT: continual rapid series of measurements over a five minute period.
■ Sequence: continually automatic measurement at set durations and intervals.

12.5 NIBP Display
The NIBP display shows only numerics.
12.6 Preparing for NIBP Measurements

12.6.1 Preparing the Patient for NIBP Measurements

In normal use, perform NIBP measurement on a patient who is in the following position:

- Comfortably seated
- Legs uncrossed
- Feet flat on the floor
- Back, arm and feet supported

NOTE

- It is recommended that the patient remains calm and relaxes as much as possible before performing the measurement and that the patient does not talk during the measurement.
- Other factors that have been shown to result in an overestimation of blood pressure are labored breathing, full bladder, pain etc.

12.6.2 Placing the NIBP Cuff

To place the NIBP cuff, follow this procedure:

1. Verify that the patient category setting is correct.
2. Connect the air tubing to the NIBP connector on the monitor.
3. Select an appropriately sized cuff for the patient, and then wrap it around the limb directly over the patient's skin as follows:
   a. Determine the patient's limb circumference.
   b. Select an appropriate cuff by referring to the limb circumference marked on the cuff. The width of the cuff should be 40% (50% for neonates) of the limb circumference, or 2/3 of the length of the upper arm.
arm or the thigh. The inflatable part of the cuff should be long enough to encircle to overlap at least 50% to 80% of the limb.

c Apply the cuff to the patient’s upper arm or leg and make sure the Φ marking on the cuff matches the artery location. The cuff should fit snugly, but with enough room for two fingers to be placed between the cuff and the patient’s arm (on adults), and loosely on neonates with little or no air present within the cuff. Otherwise it may cause discoloration and ischemia of the extremities. Make sure that the cuff index line falls within the range markings on the cuff. If it does not, use a cuff that fits better.

d Middle of the cuff should be at the level of the right atrium of the heart. If it is not, use the measurement correction formula to correct the measurement. For more information, see 12.8.10 Correcting the NIBP Measurements.

4. Connect the cuff to the air tubing. Avoid compression or restriction of pressure tubes. Air must pass unrestricted through the tubing.

**CAUTION**

- Do not touch or apply external pressure against the cuff and air tubing during NIBP measurement. This may cause inaccurate blood pressure values.
- Use care when placing the cuff on an extremity used for monitoring other patient parameters.

### 12.7 Starting and Stopping NIBP Measurements

Start and stop NIBP measurement by selecting the NIBP quick keys or from the NIBP dialog.

<table>
<thead>
<tr>
<th>Task</th>
<th>By Quick Key</th>
<th>From NIBP dialog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start a manual measurement</td>
<td>NIBP Start/Stop quick key</td>
<td>Start NIBP button</td>
</tr>
<tr>
<td>Start auto NIBP series</td>
<td>NIBP Start/Stop quick key</td>
<td>Setup tab → set Interval → Start NIBP button</td>
</tr>
<tr>
<td></td>
<td>NIBP Measure quick key [select interval]</td>
<td></td>
</tr>
<tr>
<td>Start NIBP sequence measurement</td>
<td>NIBP Measure quick key → Sequence</td>
<td>Sequence tab → set NIBP sequence → Start NIBP button</td>
</tr>
<tr>
<td>Start STAT measurement</td>
<td>NIBP Measure quick key → STAT</td>
<td>STAT button</td>
</tr>
<tr>
<td>Stop the current NIBP measurements</td>
<td>NIBP Start/Stop quick key</td>
<td>Stop NIBP button</td>
</tr>
<tr>
<td>End auto NIBP series or NIBP Sequence</td>
<td>/</td>
<td>Stop All button</td>
</tr>
<tr>
<td>Stop STAT measurement and end series</td>
<td>NIBP Start/Stop quick key</td>
<td>Stop NIBP or Stop All button</td>
</tr>
</tbody>
</table>

### 12.8 Changing NIBP Settings

#### 12.8.1 Setting the NIBP Alarm Properties

To set the NIBP alarm properties, follow this procedure:

1. Select the NIBP numeric area to enter the NIBP dialog.
2. Select the Alarm tab.
3. Enter the password if required. For more information, refer to 21.12.3 Selecting Password for User Authentication.

4. Set the alarm properties as desired.

12.8.2 Setting the Initial Cuff Inflation Pressure
To set initial cuff inflation pressure, follow this procedure:
1. Select the NIBP numeric area to enter the NIBP dialog.
2. Select Initial Pressure, and then select the appropriate setting.

NOTE
• For known hypertensive patients, you need to set initial cuff pressure to a higher value to reduce the measurement time.

12.8.3 Setting the NIBP Interval
For auto NIBP measurement, you need to set the interval between two NIBP measurements. To set the NIBP interval, follow this procedure:
1. Select the NIBP numeric area to enter the NIBP dialog.

NOTE
• NIBP Measure dialog gives quick access to starting and setting the interval. Selecting an option from the NIBP Measure dialog will change the NIBP interval to that selection and start the NIBP measurement.

12.8.4 Selecting NIBP Start Mode
Start mode defines how NIBP auto mode works. To set the start mode, follow this procedure:
1. Select the NIBP numeric area to enter the NIBP dialog.
2. Set Start Mode.
   ◆ Clock: after the first measurement, the monitor automatically synchronizes NIBP automatic measurements with the real time clock. For example, if Interval is set to 20 min, and NIBP auto measurement is started at 14:03, the next measurement will be taken at 14:20, and then at 14:40, 15:00, and so on.
   ◆ Interval: after the first measurement, the monitor automatically repeats measurements at set interval. For example, if Interval is set to 20 min, and NIBP auto measurement is started at 14:03, the next measurement will be taken at 14:23, and then at 14:43, 15:03, and so on.

12.8.5 Enabling the NIBP End Tone
The monitor can issue a reminder tone at the completion of NIBP measurement. The NIBP End Tone is off by default. To switch on the NIBP end tone, follow this procedure:
1. Select the NIBP numeric area to enter the NIBP dialog.
2. Switch on NIBP End Tone.

12.8.6 Setting NIBP Sequence
NIBP sequence measurement can have up to five phases: A, B, C, D, and E. The duration and interval of each phase can be set individually.

To set NIBP sequence, follow this procedure:
1. Select the NIBP numeric area to enter the NIBP dialog.
2. Select the **Sequence** tab.
3. Set **Duration** and **Interval** of each phase.

### 12.8.7 Setting the NIBP Display Format

To set the NIBP display format, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Select the **Setup** tab.
3. Set **Display Format**.

### 12.8.8 Setting the NIBP Alarm Limits Display Switch

To set whether to display the alarm limits of diastolic NIBP and mean NIBP, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Select the **Setup** tab.
3. Switch on or off **Display Alarm Limits**.

### 12.8.9 Showing/Hiding PR

You can set whether to display the PR value in the NIBP parameter area. To do so, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Select the **Setup** tab.
3. Switch on or off **Display PR**.

### 12.8.10 Correcting the NIBP Measurements

The middle of the cuff should be at the level of right atrium. If the limb is not at the heart level, the measurement should be corrected as follows:

- Add 0.75 mmHg (0.10 kPa) to the displayed value for each centimetre higher.
- Deduct 0.75 mmHg (0.10 kPa) to the displayed value for each centimeter lower.

### 12.9 Assisting Venous Puncture

You can use the NIBP cuff to cause sub-diastolic pressure to block the venous blood vessel and therefore help venous puncture. To assist venous puncture, follow this procedure:

1. Select the NIBP numeric area → **Setup** tab.
2. Set **Venipuncture pressure**.
3. Select **VeniPuncture** at the bottom of the dialog.
4. Puncture vein and draw blood sample.
5. Select the **NIBP Start/Stop** quick key to deflate the cuff. If the cuff is not manually deflated, the cuff automatically deflates after a fixed period of time (170 seconds for adult and pediatric patient, 85 seconds for neonatal patient).

During venous puncture, pay attention to the cuff pressure and the remaining time displayed in the NIBP numerics area.

### 12.10 NIBP Troubleshooting

This section lists the problems that might occur. If you encounter the problems when using the equipment or accessories, check the table below before requesting for services. If the problem persists, contact your service personnel.
**NOTE**

- For the physiological and technical alarm messages, see Appendix D Alarm Messages.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot see NIBP numeric area on the main screen</td>
<td>1. Check that the NIBP is set to display in the <strong>Screen Setup → Tile Layout</strong> page. For more information, see 3.11.2 Displaying Parameter Numerics and Waveforms. Check that if the NIBP parameter switch is enabled. If not, enable the NIBP measurement. For more information, see 3.11.1 Switching On or Off a Parameter.</td>
</tr>
</tbody>
</table>
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13 Monitoring Invasive Blood Pressure (IBP)

13.1 IBP Introduction

This patient monitor can monitor up to two invasive blood pressures and displays the systolic, diastolic and mean pressures and a waveform for each pressure.

IBP monitoring is intended for adult, pediatric, and neonatal patients. PAWP monitoring is only intended for adult and pediatric patients.

NOTE

• PAWP monitoring is available only when using an external display.

WARNING

• Use only pressure transducers specified in this manual. Never reuse disposable pressure transducers. See chapter 25 Accessories for specified pressure transducers.

• Make sure that the applied parts never contact other conductive parts.

• To reduce the hazard of burns during high-frequency surgical procedures, ensure that the monitor’s cables and transducers never come into contact with the high-frequency surgical units.

• When using accessories, their operating temperature should be taken into consideration. For more information, see instructions for use of accessories.

• All invasive procedures involve risks to the patient. Use aseptic technique. Follow catheter manufacturer’s instructions.

• Mechanical shock to the invasive blood pressure transducer may cause severe shifts in zero balance and calibration, and cause erroneous readings.

• The neutral electrode of the electro-surgery unit (ESU) shall properly contact the patient. Otherwise, burns may result.
13.2 Preparing for IBP Monitoring

13.2.1 IBP Equipment to Patient Connection

To monitor IBP, follow this procedure:

1. Connect one end of the IBP cable to the IBP cable connector on the monitor, and the other end to the IBP transducer.

2. Flush the IBP transducer system to exhaust all air from the tubing according to the manufacturer’s instructions. Ensure that the system is free of air bubbles.

3. Connect the IBP transducer to the patient, making sure that the transducer is at the same horizontal level as the heart.

4. Select the proper pressure label for currently measured pressure. For more information, see 13.5.2 Changing the Pressure Label.

5. Zero the IBP transducer. For more information, see 13.2.3 Zeroing the IBP transducer. After a successful zeroing, turn off the three-way valve to the air and turn on the three-way valve to the patient.

CAUTION

- Make sure that all the transducers are zeroed correctly before making IBP measurements.
- Make sure that all air bubbles have been flushed from the IBP transducer system before making IBP measurements.
• If measuring intracranial pressure (ICP) with a sitting patient, level the transducer with the top of the patient's ear. Incorrect leveling may give incorrect values (not applicable if measuring ICP with the Codman ICP transducer).

NOTE
• If two invasive blood pressures measurements are needed, use the IBP extension cable with dual-receptacle (PN: 040-001029-00) instead of the IBP cable.

13.2.3 Zeroing the IBP transducer
To avoid inaccurate pressure readings, the monitor requires a valid zero. Zero the transducer in accordance with your hospital policy. The IBP transducer should be zeroed in the following conditions:

■ The IBP transducer or adapter cable is reconnected.
■ The monitor restarts.
■ The readings are in doubt.
■ The monitor displays the prompt message **Zero Required**.

To zero the transducer, follow this procedure:
1. Connect the IBP transducer, the IBP adapter cable and the monitor.
2. Turn off the three-way valve (the one near the transducer) to the patient, in order to vent the transducer to the atmospheric pressure.
3. Select the numeric area (such as the Art numeric area), and then select **Zero** button.
4. After the zero calibration is completed, close the three-way valve to the air and open the three-way valve to the patient.

Zero calibration may fail in case of pressure fluctuation or pressure exceeding the calibration range. If zero calibration fails, follow this procedure:
1. Check that the three-way valve (the one near the transducer) is open to the air.
2. Perform zero calibration again. Do not sway the IBP transducer and tubing during zero calibration.

13.3 Measuring ICP Using the Codman ICP Transducer

13.3.1 Zeroing the Codman ICP transducer
The Codman ICP transducer (Model: 82-6653) must be zeroed before use. To zero the ICP transducer, follow this procedure:
1. Connect the ICP transducer, the ICP adapter cable and the monitor.
2. Follow the manufacturer's instructions to prepare the ICP transducer.
3. Zero the ICP transducer: when the message **Zero Reference** is displayed in the ICP numeric area, select the ICP waveform area or numeric area to enter the **ICP** dialog → select the **Zero** tab → select the **Zero** button.
4. Record the zero reference value on the blank area of the ICP transducer for future reference.

If the ICP transducer zero calibration failed or the zero reference value is in doubt, perform the zero calibration again.

13.3.2 Measuring ICP
To perform the ICP measurement, follow this procedure:
1. Zero the Codman ICP transducer. For more information, see section 13.3.1 Zeroing the Codman ICP transducer.
2. Disconnect the ICP transducer and ICP adapter cable. Follow the manufacturer's instructions to apply the ICP transducer to the patient.
3. Reconnect the ICP transducer and ICP adapter cable.
4. Check that the zero reference value displayed on the monitor is consistent with that recorded on the ICP transducer.
   - Consistent: select Accept.
   - Inconsistent: input the zero reference value recorded on the ICP transducer, and select Accept.

If the patient being monitored for ICP must be transported, and N1 is not used for transport, check that the transport monitor supports the Codman ICP transducer. If the transport monitor does not support the Codman ICP transducer, do not use it for ICP monitoring.

If the transport monitor supports the Codman ICP transducer, follow this procedure to transport the patient:

1. Disconnect the ICP adapter cable from the N1.
2. Connect the ICP adapter cable and the transport monitor.
3. Check that the zero reference value displayed on the monitor is consistent with that recorded on the ICP transducer.
   - Consistent: select Accept.
   - Inconsistent: input the zero reference value recorded on the ICP transducer, and select Accept.

---

**CAUTION**

- If monitors of different brands are used to zero the Codman ICP transducer, the zero reference values can be different. Use a Mindray monitor to Zero the Codman ICP transducer if you will take ICP measurement using a Mindray monitor. Otherwise the ICP measurement could be inaccurate.

---

**13.4 IBP Display**

The IBP measurement is displayed on the monitor as a waveform and numeric pressures. For arterial pressure, the IBP numeric area displays systolic pressure, diastolic pressure and mean pressure. For venous pressure, the IBP numeric area displays only the mean pressure. The figure below shows the waveform and numerics for the Art pressure.

- (1) Pressure label
- (2) Waveform
- (3) Pressure Unit
- (4) Systolic pressure
- (5) Diastolic pressure
- (6) Mean pressure
- (7) PPV measurement

For some pressures, the parameter window may show the mean pressure only. For different pressures, their defaults unit may be different. If the Art and ICP pressures are measured simultaneously, the ICP parameter area will display numeric CPP, which is obtained by subtracting ICP from the Art mean.

---

**13.4.1 Overlapping IBP Waveforms**

The IBP waveforms can be displayed together. To combine IBP waveforms, follow this procedure:

1. Access Tile Layout by either of the following ways:
   - Select the Screen Setup quick key → select the Tile Layout tab.
   - Select Main Menu quick key → from the Display column select Tile Layout.
2. Select the waveform area where you want to display the overlapped IBP waveforms, and then select the IBP waves to be overlapped on the left side of the same line.

3. Repeat step 2 in another waveform area if needed.

4. Select \(\Box\) to save the setting and exit the screen. The main screen will display the overlapped IBP waves.

Selecting the overlapped IBP waveforms opens the Overlapping Waveform Setup dialog, where you can make the following settings:

- **Scale**
  - Set **Left Scale** for the arterial pressure.
  - Set **Right Scale** for the venous pressure.
  - Set **CVP Scale** individually if the CVP waveform is combined and CVP unit is different from IBP unit.
  - Set **ICP Scale** individually if the ICP waveform is combined and ICP unit is different from IBP unit.
  - Set **PA Scale** individually if the PA waveform is combined.

- **Switch on or off Gridlines** to show or hide gridlines in the overlapped waveform area.

- **Set Speed** for the overlapped waveforms.

**NOTE**

- The unit of CVP scale is consistent with the CVP parameter unit.

### 13.5 Changing IBP Settings

#### 13.5.1 Changing the IBP Alarm Settings

To change the IBP alarm settings, follow this procedure:

1. Select the IBP numeric area or waveform area to enter the corresponding pressure dialog.
2. Select the **Alarm** tab.
3. Enter the password if required. For more information, refer to 21.12.3 Selecting Password for User Authentication.
4. Set the alarm properties of pressure.

#### 13.5.2 Changing the Pressure Label

The pressure label is a unique identifier for each type of pressure. Therefore, it is recommended to select the proper pressure label for the source of the pressure being monitored.

To select the pressure label, follow this procedure:

1. Select the IBP numeric area or waveform area to enter the corresponding pressure dialog.
2. Select the **Setup** tab.
3. Set IBP1 Label or IBP2 Label.

<table>
<thead>
<tr>
<th>Label</th>
<th>Description</th>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art</td>
<td>Arterial blood pressure</td>
<td>PA</td>
<td>Pulmonary artery pressure</td>
</tr>
<tr>
<td>Ao</td>
<td>Aortic pressure</td>
<td>UAP</td>
<td>Umbilical arterial pressure</td>
</tr>
<tr>
<td>BAP</td>
<td>Brachial arterial pressure</td>
<td>FAP</td>
<td>Femoral arterial pressure</td>
</tr>
<tr>
<td>CVP</td>
<td>Central venous pressure</td>
<td>LAP</td>
<td>Left atrial pressure</td>
</tr>
<tr>
<td>RAP</td>
<td>Right atrial pressure</td>
<td>ICP</td>
<td>Intracranial pressure</td>
</tr>
<tr>
<td>UVP</td>
<td>Umbilical venous pressure</td>
<td>LV</td>
<td>Left ventricular pressure</td>
</tr>
<tr>
<td>P1 to P4</td>
<td>Non-specific pressure label</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**

- The same label cannot be selected for different pressures. When two pressures are detected having the same label, the monitor automatically changes one pressure label to a currently unused one.

### 13.5.3 Setting the Pressure Type for Display

For the non-specific pressure (P1, P2, P3 or P4), the displayed pressure type is configurable. To set the displayed pressure type, follow this procedure:

1. Select the numeric area or waveform area of the non-specific pressure to enter the corresponding pressure dialog.
2. Select the Setup tab.
3. Set Measure:
   - If this non-specific pressure is arterial pressure, set the Measure to All. In this case, its corresponding numeric area displays systolic pressure, diastolic pressure and mean pressure.
   - If this non-specific pressure is venous pressure, set the Measure to Mean Only. In this case, its corresponding numeric area displays only the mean pressure.

### 13.5.4 Changing the Sensitivity

The IBP value displayed on the monitor screen is the average of data collected within a specific time. The shorter the averaging time is, the quicker the monitor responds to changes in the patient's blood pressure, and the higher the sensitivity. Contrarily, the longer the averaging time is, the slower the monitor responds to changes in the patient's blood pressure, the lower the sensitivity, but the measurement accuracy will be improved. For critically ill patients, selecting higher sensitivity will help with understanding the patient's state.

To set the sensitivity, follow this procedure:

1. Select the IBP numeric area or waveform area to enter the corresponding pressure dialog.
2. Select the Setup tab.

### 13.5.5 Setting the IBP Waveform

To set the IBP waveform, follow this procedure:

1. Select the IBP numeric area or waveform area to enter the corresponding pressure dialog.
2. Select the Setup tab.
3. Set the following properties of the IBP waveform:
   - Speed
   - Scale: if Auto is selected, the size of the pressure's waveform will be adjusted automatically.
13.5.6 Setting the Display Format of Artery Pressure

To set the display format of the artery pressure, follow this procedure:
1. Select the numeric area or waveform area of any arterial pressure to enter the corresponding menu.
2. Select the Setup tab.

13.5.7 Showing/Hiding the Alarm Limits of Artery Pressure

To set whether to display the alarm limits of the arterial pressure, follow this procedure:
1. Select the numeric area or waveform area of any arterial pressure to enter the corresponding menu.
2. Select the Setup tab.
3. Switch on or off Display Alarm Limits.

13.5.8 Setting the Use PA-D as PAWP Switch (only available when the N1 is used with the independent external display)

The PA-D value can be configured to replace the PAWP value for hemodynamic calculation. To do so, follow this procedure:
1. Select the PA numeric area or waveform area to enter the PA dialog.
2. Select the Setup tab.
3. Switch on or off Use PA-D as PAWP.

For more information on hemodynamic calculation, see 17.4 Hemodynamic Calculations.

13.5.9 Enabling PPV Measurement

PPV indicates pulse pressure variation. When measuring the arterial pressure (except PA), the PPV measurement is available. To enable the PPV measurement, follow this procedure:
1. Select the IBP numeric area or waveform area to enter the corresponding pressure dialog.
2. Select the PPV Setup tab.
3. Switch on PPV Measure.

You can select PPV source after enabling the PPV measurement.

---

**WARNING**

- This monitor can calculate PPV from beat-to-beat values of any arterial pulsatile pressure. The circumstances under which the calculation of a PPV value is clinically meaningful, appropriate and reliable must be determined by a physician.
- The clinical value of the derived PPV information must be determined by a physician. According to recent scientific literature, the clinical relevance of PPV information is restricted to sedated patients receiving controlled mechanical ventilation and mainly free from cardiac arrhythmia.
- PPV calculation may lead to inaccurate values in the following situations:
  - at respiration rates below 8 rpm
  - during ventilation with tidal volumes lower than 8 ml/kg
  - for patients with acute right ventricular dysfunction (cor pulmonale).
- The PPV measurement has been validated only for adult patients.

13.6 PAWP (only available when the N1 is used with the independent external display)

Pulmonary Artery Wedge Pressure (PAWP) values, used to assess cardiac function, are affected by fluid status, myocardial contractility, and valve and pulmonary circulation integrity.
Obtain the measurement by introducing a balloon-tipped pulmonary artery flotation catheter into the pulmonary artery. When the catheter is in one of the smaller pulmonary arteries, the inflated balloon occludes the artery allowing the monitor to record changes in the intrathoracic pressures that occur throughout the respiration cycle.

The pulmonary wedge pressure is the left ventricular end diastolic pressure when the airway pressure and valve function are normal. The most accurate PAWP values are obtained at the end of the respiration cycle when the intrathoracic pressure is fairly constant and the artifact caused by respiration is minimal.

**WARNING**

- PAWP monitoring is not intended for neonatal patients.

### 13.6.1 PAWP Equipment to Patient Connection

![Diagram of PAWP equipment connection]

(1) N1 monitor (2) Flush bag
(3) IBP transducer (4) Three-way valve
(5) PA distal port (6) Balloon inflation syringe
(7) Thermodilution catheter (8) Balloon

### 13.6.2 Preparing to Measure PAWP

To prepare to monitor PAWP, follow this procedure:

1. Connect the IBP transducer, the IBP cable and the module. For more information, see 13.2.2 *Measuring an Invasive Blood Pressure*.

2. Follow the manufacturer’s instructions to connect the PA port of the thermodilution catheter and the patient end of the IBP transducer.
3. Zero the IBP transducer. For more information, see 13.2.3 Zeroing the IBP transducer.

4. Set the IBP label to **PA** since the PAWP is measured on PA. For more information, see 13.5.2 Changing the Pressure Label.

### 13.6.3 Measuring PAWP

To measure the PAWP, follow this procedure:

1. Select the PA numeric area or waveform area to enter the **PA** dialog, and then select **PAWP**.

2. Wedge the flotation catheter into the pulmonary artery by observing the PA waveform changes on the screen, referring to the following figure.

3. Select **Start**.

4. Inflate the balloon and pay attention to PA waveform changes on the screen when the prompt message **Ready For Balloon Deflation** appears.

5. Deflate the balloon when the prompt message **Ready For Balloon Deflation** appears. If the PA waveform is stable, but the monitor is still not showing the prompt message **Ready For Balloon Deflation**, select **Freeze** to freeze the waveform, and deflate the balloon.

6. Select **Accept** to save the PAWP value.

7. If you need to start a new measurement, repeat step 3 to step 6.

If the measurement fails or you need to adjust the PAWP value, you can use the following buttons to adjust the PAWP waveform and measurement.
- Select the up or down arrow button to adjust the PAWP value.
- Select the left or right arrow button to view the frozen waveforms of 40 seconds.
- Select Accept to save the PAWP value.

WARNING

• Prolonged inflation can cause pulmonary hemorrhage, infarction or both. Inflate the balloon for the minimum time necessary to get an accurate measurement.
• If the PAWP is greater than the PA (systolic), deflate the balloon and report the incident in accordance with hospital policy. Because the pulmonary artery could be accidentally ruptured, and the PAWP value derived will not reflect the patient's hemodynamic state, but will merely reflect the pressure in the catheter or balloon.
• If the flotation/thermodilution catheter drifts into the wedge position without inflation of the balloon, the PA waveform assumes a wedged appearance. Take appropriate action, in accordance with standard procedures, to correct the situation.

NOTE

• The PA alarm is turned off automatically when the monitor enters the PAWP screen.

13.6.4 Setting the Waveforms of the PAWP Screen

On the PAWP screen, select Setup to enter the PAWP Setup dialog. In the PAWP Setup dialog, you can make the following settings:
- Select Reference Waveform 1 to set an ECG lead wave as the first reference wave.
- Select Reference Waveform 2 to set a respiration wave as the second reference wave.
- Select Speed to set a sweep speed for the displayed waveforms on the PAWP screen.
- Select Scale to set the size of the PA waveform on the PAWP screen.

13.6.5 Performing Hemodynamic Calculation (only available when the N1 is used with the independent external display)

On the PAWP screen, select Hemo Calcs to enter the Calculations dialog. For more information, see 17.4 Hemodynamic Calculations.

13.7 IBP Troubleshooting

This section lists the problems that might occur. If you encounter the problems when using the equipment or accessories, check the table below before requesting service. If the problem persists, contact your service personnel.

NOTE

• For the physiological and technical alarm messages, see Appendix DAlarm Messages.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
</table>
| Cannot see IBP numeric area or waveform area on the main screen | 1. Check that the IBP is set to display in the Screen Setup dialog. For more information, see 3.11.2 Displaying Parameter Numerics and Waveforms.  
2. Check that if the IBP parameter switch is enabled. If not, enable the IBP measurement. For more information, see 3.11.1 Switching On or Off a Parameter.  
3. Check the connection of IBP cable, IBP transducer and module.  
4. Check that the three-way valve is turned to the correct position.  
5. Check that the IBP transducer has been zeroed. For more information, see 13.2.3 Zeroing the IBP transducer. |
### Problem and Solution

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot see systolic pressure and diastolic pressure for P1/P2/P3/P4</td>
<td>Set <strong>Measure to All</strong> in the P1/P2/P3/P4 setup page. For more information, see 13.5.3 <em>Setting the Pressure Type for Display</em>.</td>
</tr>
<tr>
<td>IBP readings seem unstable</td>
<td>1. Make sure there are no air bubbles in the transducer systems.</td>
</tr>
<tr>
<td></td>
<td>2. Check that the transducer is properly fixed.</td>
</tr>
<tr>
<td></td>
<td>3. Zero the transducer again.</td>
</tr>
<tr>
<td></td>
<td>4. Replace the transducer.</td>
</tr>
<tr>
<td>Zeroing of IBP channel(s) fails.</td>
<td>1. Ensure that the channels are open to air.</td>
</tr>
<tr>
<td></td>
<td>2. Perform zero calibration again. Do not sway the IBP transducer and tubing during zero calibration.</td>
</tr>
<tr>
<td></td>
<td>3. If zero calibration still fails, replace the transducer.</td>
</tr>
</tbody>
</table>
14 Monitoring Carbon Dioxide (CO₂)

14.1 CO₂ Introduction

CO₂ monitoring is a continuous, non-invasive technique for determining the concentration of CO₂ in the patient’s airway by measuring the absorption of infrared (IR) light of specific wavelengths. CO₂ has its own absorption characteristic and the amount of light passing the gas probe depends on the concentration of the measured CO₂. When a specific band of IR light passes through respiratory gas samples, some of IR light will be absorbed by the CO₂ molecules. The amount of IR light transmitted after it has been passed through the respiratory gas sample is measured with a photodetector. From the amount of IR light measured, the concentration of CO₂ is calculated.

CO₂ measurement is used to monitor the patient’s respiratory status. The sidestream/Microstream CO₂ measurement takes a sample of the respiratory gas with a constant sample flow from the patient’s airway and analyzes it with a remote CO₂ sensor built into the Sidestream or Microstream CO₂ module.

The sidestream CO₂ module can be configured with a paramagnetic oxygen sensor to measure O₂. The paramagnetic oxygen sensor measures oxygen based on its paramagnetic properties.

The sidestream and microstream CO₂ measurement can be used, with specified accessories, with intubated and non-intubated adult, pediatric, and neonatal patients. With intubated patients, a sample of the respiratory gas is drawn from the patient’s breathing circuit through an airway adapter and a gas sampling line. With non-intubated patients, the gas sample is drawn through a nasal cannula.

CO₂ monitoring is intended for adult, pediatric and neonatal patients.

WARNING

- The N1 monitor does not support CO₂ measurements when used for transporting patients by rotary or fixed-wing ambulance.
- It is not recommended to measure O₂ when transporting a patient with the N1 monitor. Shaking the CO₂ module during O₂ measurement may lead to a distorted O₂ waveform or inaccurate O₂ measurement.

14.2 Identifying CO₂ Modules

To measure CO₂, use either the internal CO₂ module or the external CO₂ module. The external CO₂ module is connected to the N1 through the Modular Rack. For the connection of the N1 and the external CO₂ module, see section 2.8.1 Installing the N1 or External Parameter Module into the Modular Rack.

In sequence from left to right, the following are sidestream CO₂ external module, microstream CO₂ external module, and N1 monitor with internal CO₂ module.
14.3 **CO₂ Safety Information**

**WARNING**
- Route all tubing away from the patient’s throat to avoid strangulation.

**CAUTION**
- Remove the airway sample line from the patient’s airway while nebulized medications are being delivered. Measuring CO₂ during nebulization may lead to inaccurate CO₂ readings.
- EtCO₂ values measured from the CO₂ module may differ from those from the blood gas analysis.
- Avoid mechanical shock to the sidestream CO₂ module.

**NOTE**
- The CO₂ module automatically suppresses physiological alarms until breathing waves have been detected. Ensure that the patient is properly connected when using the CO₂ module.

14.4 **CO₂ Measurement Limitations**

The following factors may influence the measurement accuracy:

- Leaks or internal venting of sampled gas
- Mechanical shock
- Cyclic pressure up to 10 kPa (100 cmH₂O)
- Other sources of interference, if any

For more information, refer to A.14.8 CO₂ Specifications.

**CAUTION**
- Measurement accuracy of the sidestream CO₂ module may be affected by the breath rate and inspiration/expiration (I/E) ratio.
- Measurement accuracy of the microstream CO₂ module may be affected by the breath rate.

14.5 **CO₂ Display**

The CO₂ numeric and waveform areas provide FICO₂ measurement, EtCO₂ measurement, awRR measurement, and a CO₂ waveform.
If the sidestream CO₂ module is configured with the oxygen sensor, O₂ waveform and parameters can be displayed in an O₂ numeric and waveform area as follows:

![CO₂ and O₂ waveforms](image)

(1) O₂ waveform  (2) FiO₂ measurement  (3) EtO₂ measurement

14.6 Measuring CO₂ Using the Sidestream/Microstream CO₂ Module

14.6.1 Preparing to Measure CO₂ Using the Sidestream CO₂ Module

To prepare the sidestream CO₂ measurement, follow this procedure:

1. Select the appropriate gas sample line and watertrap according to the patient category.
2. Connect one end of the gas sample line to the watertrap or to the CO₂ adapter.
   - If using the sidestream CO₂ module, connect the watertrap to the CO₂ module, and connect the gas sample line to the watertrap.
   - If using the N1 monitor for CO₂ measurement, connect one end of the gas sample line to the CO₂ adapter. Refer to the CO₂ Adapter User Manual (PN: H-046-009994-00) for the connection of the CO₂ adapter and the gas sampling line.
3. Connect the other end of the gas sample line to the patient.
   - For intubated patients requiring an airway adapter, install the airway adapter between the patient circuit and the ventilator Y-piece.
   - For non-intubated patients, place the nasal cannula onto the patient.

4. Connect the gas outlet to the scavenging system using an exhaust tube.

After the CO₂ module is connected, it enters measure mode by default and the monitor displays **CO₂ Starting**. CO₂ can be measured after the start-up sequence is complete.

---

**WARNING**

- Do not use the adult or pediatric watertrap with a neonate patient. Otherwise, patient injury could result.
- Connect the gas outlet to the scavenging system when measuring CO₂ using the sidestream CO₂ module.

---

**CAUTION**

- Check the compatibility of the CO₂ adapter and the sampling line before use. The CO₂ adapter is intended for connecting an Oridion CO₂ sampling line.
Leakage in the breathing or sampling system may cause the displayed EtCO₂ values to be significantly low. Always make sure that all components are securely connected.

Inspect the airway adapter for a tight connection and proper operation before attaching it to the patient.

Squeezing or bending the sample line during sidestream or microstream CO₂ measurement may cause inaccurate CO₂ readings or no reading.

To avoid blocking the airway, empty the DRYLINE II watertrap container whenever half full. Replacing the DRYLINE II watertrap once a month is recommended.

The DRYLINE II watertrap has a filter preventing bacterium, water and secretions from entering the module. Extended use could destroy the filter in watertrap and fail to stop the bacterium, water and secretions entering the module, result in damaging the gas module and having infection risk.

**NOTE**

- It is recommended to replace the CO₂ adapter at least once a year.
- To extend the lifetime of the watertrap and module, disconnect the watertrap from the module and set the operating mode to Standby mode when CO₂ monitoring is not required.
- The sample rates are different when different types of watertraps are used.
- The emptying interval of the DRYLINE II adult/pediatric watertrap is 26 hours @ 120 ml/min, sample gas of 37 °C, room temperature of 23ºC, and 100% RH.
- The emptying interval of the DRYLINE II neonatal watertrap is 35 hours @ 90 ml/min, sample gas of 37 °C, room temperature of 23ºC, and 100% RH.

### 14.6.2 Preparing to Measure CO₂ Using the Microstream CO₂ Module

To prepare the CO₂ module for measurement, follow this procedure:

1. Connect one end of the sample line to the microstream CO₂ module.

2. Connect the other end of the sample line to the patient.
   - For intubated patient requiring an airway adapter, install the airway adapter between the patient circuit and the ventilator Y-piece.
   - For non-intubated patient, place the nasal cannula onto the patient.
   - For patient prone to mouth breathing, place the oral-nasal cannula onto the patient.

3. Connect the gas outlet to the a scavenging system using an exhaust tube.

After the CO₂ module is connected to the N1, it enters measure mode by default and the monitor displays **CO₂ Sensor Warmup**. CO₂ can be measured after the start-up sequence is complete.
WARNING

- Connect the gas outlet to the scavenging system when measuring CO₂ using the microstream CO₂ module.

NOTE

- Disconnect the sample line from the module when CO₂ monitoring is not required.

14.6.3 Zeroing the Sidestream/Microstream CO₂ Module

The sidestream or microstream CO₂ module performs zero calibration automatically when needed.

NOTE

- The CO₂ module temporarily stops measuring during zeroing.

14.7 Changing Settings for All CO₂ Modules

14.7.1 Changing CO₂ Alarm Settings

To change the CO₂ alarm settings, follow this procedure:
1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Alarm tab.
3. Enter the password if required. For more information, refer to 21.12.3 Selecting Password for User Authentication.
4. Set alarm properties as desired.

14.7.2 Setting the CO₂ Waveform

To set the CO₂ waveform, follow this procedure:
1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Setup tab.
3. Set Waveform Type, Speed, Scale, or CO₂ Scale of the CO₂ waveform.

14.7.3 Setting the RR Source

To set the respiration rate (RR) source, follow this procedure:
1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Setup tab.
3. Set RR Source.

When you select Auto, the system automatically selects the RR source according to the priority. The priority of RR source is first CO₂, and then RM, and finally ECG. When the current RR source does not have valid measurement, the system automatically switches the RR Source to Auto.

14.7.4 Entering the Standby Mode

Set the CO₂ module to one of the following modes according to the module status:
- Select Measure mode when using the CO₂ module for monitoring.
- Select Standby mode to prolong the CO₂ module service life when not using the CO₂ module.

The default operating mode is Measure. When not using the CO₂ module, proceed as follows to enter the Standby mode:
1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Setup tab.
3. Set Operating Mode to Standby.

14.7.5 Entering the Intubation Mode

When performing intubation during general anesthesia, enter the intubation mode to reduce unnecessary alarms. To enter the intubation mode, follow this procedure:

1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select Intubation Mode.

To exit the intubation mode, choose either of the following ways:

- From the bottom of the CO₂ dialog, select Exit Intubation Mode.
- Select the Main Menu quick key → from the Alarm column select Exit Intubation Mode.

For the details of the intubation mode, see 6.11 Intubation Mode.

NOTE

• When the configured intubation period is over, the monitor automatically exits the intubation mode and gives two alert sounds.

14.7.6 Setting the Auto Standby

The monitor enters standby mode automatically if no breath is detected after the configured period of time. To set the auto standby, follow this procedure:

1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Setup tab.
3. Set Auto Standby.

14.7.7 Setting Humidity Compensation

Sidestream and microstream CO₂ modules are configured to compensate CO₂ readings for either Body Temperature and Pressure, Saturated Gas (BTPS), to account for humidity in the patient’s breath, or Ambient Temperature and Pressure, Dry Gas (ATPD).

- ATPD: \( P_{CO2}(mmHg) = CO_2(\text{vol}%) \times \frac{P_{amb}}{100} \)
- BTPS (sidestream): \( P_{CO2}(mmHg) = CO_2(\text{vol}%) \times \frac{(P_{amb} - 47)}{100} \)
- BTPS (microstream): \( P_{CO2}(mmHg) = CO_2(\text{vol}%) \times (1 - 0.03) \times \frac{P_{amb}}{100} \)

Where, \( P_{CO2}(mmHg) = \) partial pressure, vol\%=CO₂ concentration, \( P_{amb} = \) ambient pressure, and unit is mmHg.

For the sidestream and microstream CO₂ module, set the humidity compensation on or off according to the actual condition.

To set the humidity compensation, follow this procedure:

1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Setup tab.
3. Set BTPS Compensation.
   - Switch on for BTPS.
   - Switch off for ATPD.

14.8 Changing O₂ Settings (For Sidestream CO₂ Module Integrating O₂)

14.8.1 Changing O₂ Alarm Settings

To change the O₂ alarm settings, follow this procedure:
1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Alarm tab.
3. Enter the password if required. For more information, refer to 21.12.3 Selecting Password for User Authentication.
4. Set alarm properties as desired.

### 14.8.2 Setting the O₂ Waveform

To set the O₂ waveform, follow this procedure:
1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Setup tab.
3. Set Speed and O₂ Scale of the O₂ waveform.

### 14.9 Setting the Gas Compensation

The presence of interfering gas affects the CO₂ measurement. To get the best possible measurement result, it is recommended to set the gas compensation. The configured concentration of the interfering gas should be in accordance with its actual proportion.

For the microstream CO₂ module, gas compensations are not required.

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**CAUTION**

- Make sure to use the appropriate compensations. Inappropriate compensations may cause inaccurate measurement values and result in misdiagnosis.

For the sidestream CO₂ module, follow this procedure to set the gas compensation:
1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Setup tab.
3. Set the compensation according to the actual condition.

### 14.10 Choosing a Time Interval for Peak-Picking

For microstream CO₂ modules, select a time interval for picking the highest CO₂ as the EtCO₂ and the lowest as the FICO₂.

To set the time interval, follow this procedure:
1. Select the CO₂ numeric area or waveform area to enter the CO₂ dialog.
2. Select the Setup tab.
4. Toggle between Single Breath, 10 s, 20 s and 30 s.
   - Single Breath: EtCO₂ and FICO₂ are calculated for every breath.
   - 10 s, 20 s, or 30 s: EtCO₂ and FICO₂ are calculated using 10, 20, or 30 seconds of data.

### 14.11 Performing the Leakage Test

When measuring CO₂ using the internal CO₂ module or the external sidestream CO₂ module. The leakage test is required every time before the CO₂ measurement. To perform the CO₂ leakage test, follow this procedure:
1. Connect the measuring accessories as per section 14.6.1 Preparing to Measure CO₂ Using the Sidestream CO₂ Module.
2. Wait until the startup finishes. Completely block the gas inlet on the sidestream CO₂ module or on the N1. The alarm message “CO₂ Airway Occluded” will appear on the screen.
3. Continue to block the gas inlet for another one minute.
4. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
5. Select the **Module** tab → **CO2** tab.
6. Check that the current flow rate is less than 10ml/min, and the alarm message “**CO2 Airway Occluded**” does not disappear.

   This indicates that the module does not leak. If the alarm message disappears, or the flow rate is equal to 10ml/min or greater, it indicates that the module leaks. Perform the leakage test again. If the problem remains, contact your service personnel for help.

### 14.12 CO2 Calibration

For sidestream and microstream CO₂ modules, a calibration is needed every year or when the measured values have a great deviation.

To calibrate the CO₂ module, contact your service personnel.

**CAUTION**

- Connect the gas outlet to the scavenging system when calibrating the CO₂ module.

### 14.13 Test Method Used to Determine the Respiration Rate Measuring Range

To determine the RR measurement range, follow this procedure:

1. Connect the 5% CO₂ + N₂ (BAL) gas cylinder, reduction valve, rhythm generator and gas sampling path of a monitor.
2. Respectively set the rhythm generator to generate a respiration rate of 0 rpm, 6 rpm, 20 rpm, 60 rpm, 120 rpm, and 150 rpm.
3. Verify that it meets the specifications.

**NOTE**

- The rhythm generator mentioned above is a sensor/sampling site in Figure 201.101 – Test apparatus for the TOTAL SYSTEM RESPONE TIME of an RGM of ISO 80601-2-55.

### 14.14 CO₂ Troubleshooting

This section lists the problems that might occur. If you encounter the problems when using the equipment or accessories, check the table below before requesting service. If the problem persists, contact your service personnel.

**NOTE**

- For the physiological and technical alarm messages, see Appendix D Alarm Messages.

#### 14.14.1 Troubleshooting the Sidestream/Microstream CO₂ Module

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>EtCO₂ measurements too low</td>
<td>1. Check the patient status.</td>
</tr>
<tr>
<td></td>
<td>2. Check the sample line and connectors for leakage.</td>
</tr>
<tr>
<td></td>
<td>3. Ventilate the room if the environmental CO₂ concentration is too high.</td>
</tr>
</tbody>
</table>

### 14.15 Oridion Information

**Microstream**
Oridion Patents
This posting serves as notice under 35 U.S.C.§287(a) for Covidien patents: http://www.covidien.com/patents.

No Implied License
Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized CO₂ sampling consumables which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device and/or CO₂ sampling consumable.
15 Review

15.1 Review Overview

Trends are patient data collected over time and displayed in graphic, tabular, or other forms to give you a picture of how the patient’s condition is developing. You can review the trend data in the Review dialog, Minitrends screen, or OxyCRG screen (Minitrends screen and OxyCRG screen are only available when the N1 is used with the independent external display). The Review dialog also enables access to review the events, 12-lead ECG analysis results and waveforms, full disclosure waveforms, and so on.

15.2 Review Dialog

The Review dialog contains tabs to display trend data in tabular, graphic, or other forms.

15.2.1 Accessing the Review Dialog

To enter the review dialog, select the Main Menu quick key → from the Review column select the desired option.

15.2.2 Example Review Dialog

The review pages have a common structure. The graphic trends review page is taken as an example:

(1) Event type indicator: different color blocks match different types of events:
   - Red: high priority alarm event
   - Yellow: medium priority alarm event
   - Cyan: low priority alarm event
   - Green: manual event
   - White: operation-related event

(2) Current screen time line: indicates the time length of the current screen.

(3) Waveform area: displays trend curves. The color of trend curves is consistent with the color of parameter labels.
15.2.3 Symbols on Review Pages

The following table lists the symbols on review pages.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slider: indicates the position of current screen time in the entire time length. Dragging the slider left or right enables you to locate the trend data at a specific time and also refreshes data in current screen accordingly.</td>
</tr>
<tr>
<td></td>
<td>Goes to the previous or next event.</td>
</tr>
<tr>
<td></td>
<td>Event list: displays events in a chronological order. The most recent event is displayed at the top. The number of asterisk symbols before an event indicates alarm priority.</td>
</tr>
<tr>
<td></td>
<td>Print button: select it to output patient information and data through the printer.</td>
</tr>
</tbody>
</table>

15.2.4 Common Operations

This section describes common operations for all review pages.

15.2.4.1 Browsing Trend Data

Browse trend data in one of the following ways:
- Move the cursor.
- Move the slider.
- Slide your finger on the screen.

15.2.4.2 Viewing Events

You can view the following types of events:
- Manually triggered events
- Parameter-related operation events and alarm-related events
- Operation events not related to parameters, such as system time change

View events in either of the following ways:
- Select and select the desired event.
- Select or to jump to the previous event or next event.

Events are displayed in a chronological order. The most recent event is displayed at the top. The number of asterisk symbols before an event indicates alarm priority as follows:
- ***: high priority alarm
15.2.5 Tabular Trends Review Page

The tabular trends review page displays trend data in a tabular form. To enter the tabular trends review page, select the Main Menu quick key → from the Review column select Tabular Trends.

15.2.5.1 Editing the Tabular Trend Group

The setting of the Trend Group defines the contents of displayed trends. It is possible to edit any trend group except for the All and Standard trend groups. To do so, follow this procedure:

1. Enter the tabular trends review page:
2. Select Group Setup → select the desired tab.
   - Rename the trend group (optional): select the symbol at the upper left corner and input the desired name.
   - Add parameters: select desired parameters from the Choices column, and then select Add. Selecting Add All adds all parameters (up to the maximum of 83).
   - Delete parameters: select desired parameters from the Selected column, and then select Delete. Selecting Delete All deletes all parameters except for HR.
   - Move the position of parameters displayed on the trend page: select desired parameters from the Selected column, and then select Move up, Move Down, Move to Top, or Move to Bottom.
   - Display two parameters side by side: select two parameters from the Selected column, and then select Overlap. Then, the symbol \( \circ \) appears at the right of the overlapped parameters. The overlapped parameters will be displayed side by side in one numerics area and waveform area.
   - Unoverlap two parameters: select the overlapped parameters from the Selected column, and then select Unoverlap.

Selecting Default will restore the trend group settings to factory defaults.

NOTE

- Trend groups labeled All or Standard cannot be edited.
- The HR parameter and waveform are always displayed in the first row on the trend page. It cannot be deleted or moved.

15.2.5.2 Changing the Tabular Trend Group

To change the tabular trend group, follow this procedure:

1. Enter the tabular trends review page.
2. Set Trend Group.

15.2.5.3 Changing the Resolution of Tabular Trend Data

The interval of tabular trends defines the interval of displaying trend data. A short interval is especially suited for neonatal applications, where the clinical situation may change very quickly. In adult monitoring, where the patient's status typically changes more gradually, a longer interval may be more informative.

To change the interval of trend data, follow this procedure:

1. Enter the tabular trends review page.
2. Select Interval.
   - 5 sec or 30 sec: select to view up to 4 hours of tabular trends at an interval of 5 seconds or 30 seconds.
   - 1 min, 5 min, 10 min, 15 min, 30 min, 1 hr, 2 hrs, or 3 hrs: select to view up to 120 hours of tabular trends at the selected interval.
   - Select parameters, such as NIBP, or GCS, to view the tabular trends when these parameter measurements are acquired.
NOTE

• Changing between intervals does not typically change the position of the slider or cursor except to round it to the nearest interval, however changing intervals to be 30 seconds or less will move any cursor position more than 4 hours ago to the oldest data less than 4 hours ago.

15.2.5.4 Printing a Tabular Trends Report

To print a tabular trends report, follow this procedure:
1. Enter the tabular trends review page.
2. Select ■ to enter the Print Setup dialog.
3. Set the tabular trends report as described in 18.6.3 Configuring Tabular Trends Reports.
4. Select Print or Print (All).
   ◆ Print: the trend data before the above set Time, for the above set Period, and at the above set Interval will be printed.
   ◆ Print (All): all the stored trend data will be printed at the review interval.

15.2.6 Graphics Trends Review Page

The graphic trends review page displays trend data in a visual format. To enter the graphic trends review page, select the Main Menu quick key → from the Review column select Graphic Trends.

15.2.6.1 Changing the Graphic Trend Group

To change the graphic trend group, follow this procedure:
1. Enter the Graphic trends review page.
2. Select ■ and set Trend Group.

15.2.6.2 Editing the Graphic Trend Group

You can edit the graphic trend group by following this procedure:
1. Enter the Graphic trends review page.
2. Select ■ and select Group Setup.
3. Refer to section 15.2.5.1 Editing the Tabular Trend Group for detail on how to edit the group.

15.2.6.3 Changing the Resolution of Trend Data

To change the length of trend data displayed on the current screen, follow this procedure:
1. Enter the graphic trends review page.
2. Select Zoom.
   ◆ 8 min: the screen displays eight minutes of trend data. You can view the most recent one hour of data.
   ◆ 30 min, 1 hr, 2 hrs, 4 hrs: the screen displays 30 minutes, one hour, two hours, or four hours of trend data. You can view the most recent four hours of data.
   ◆ 8 hrs, 12 hrs, 24 hrs, 48 hrs: the screen displays 8 hours, 12 hours, 24 hours, or 48 hours of trend data. You can view the most recent 120 hours of data.

15.2.6.4 Changing the Number of Waveforms

To change the number of waveforms displayed on the trend review page, follow this procedure:
1. Enter the graphic trends review page.
2. Select ■ and set Trends.
15.2.6.5 Printing a Graphic Trends Report

To print a graphic trends report, follow this procedure:

1. Enter the graphic trends review page.
2. Select \( \text{Print Setup} \) to enter the \text{Print Setup} dialog.
3. Set the graphic trends report as described in 18.6.4 Configuring Graphic Trends Reports.
4. Select \text{Print} to print the graphic trend data before the above set \text{Time} and for the above set \text{Period}.

15.2.7 Events Review Page

The monitor stores events in real time, including technical alarm events, physiological alarm events, manual events, and operational events. When an event occurs, all the measurement numerics and three event-related waveforms 16 seconds before and after the event are stored.

**NOTE**

- Alarms are saved as events and will be maintained if the equipment is powered down. The time of equipment power down is not recorded as an event and cannot be reviewed.
- Earlier events will be overwritten by later ones if the storage capacity is reached.
- A total loss of power does not affect the events already stored.

15.2.7.1 Entering the Events Review Page

To enter the events review page, select the \text{Main Menu} quick key → from the \text{Review} column select \text{Events}.

The \text{Event} page displays the event list. Events are displayed in descending chronological order, with the most recent displayed at the top. The number of asterisk symbols before an event indicate alarm priority as described in 6.3.3 \textit{Alarm Indicators}.

Different color blocks are displayed on the left of each event to indicate different event types.

- Red: high priority alarm event
- Yellow: medium priority alarm event
- Cyan: low priority alarm event
- Green: manual event
- White: operation-related event.

The number of currently selected events and the total number of events are displayed at the top right corner of the event list. For example, 2/4 indicates that the selected event is the second event in the filtered events and the total number of filtered events is 4. Total indicates the total number of events. For example: Total: 28 means that there are a total of 28 events.

15.2.7.2 Configuring the Filter

You can filter events by time, alarm priority, alarm category, or parameter group. To configure the filter, follow this procedure:

1. Enter the \text{Events} page.
2. Select \text{Filter Setup} and set the desired filter criterion.

15.2.7.3 Editing Events

To edit events, follow this procedure:

1. Enter the \text{Events} page and tick off the desired events.
2. Select \( \text{Edit} \) to edit the selected events.
   - \text{Lock}: manually lock the event. Locked events cannot be deleted.
   - \text{Note}: enter comments for the event.
   - \text{Rename}: allow renaming an event name. Only manual events and arrhythmia events can be renamed.
15.2.7.4 Viewing Event Details
To view waveforms and parameter values at the event time, follow this procedure:

1. Enter the Events page.
2. Select Detail.

To display beat labels on the first ECG waveform, switch on Beat Anno. The white beat labels indicate heart beat classification and may explain suspected, missed, or false arrhythmia calls. Heart beats are classified as follows:

- N = Normal
- V = Ventricular ectopic
- S = Supraventricular premature
- P = Paced
- L = Learning
- ? = Insufficient information to classify beat
- I = Inoperative (for example, Lead Off)
- M = Missed beat

If you switch on Beat Anno on the Events page, beat labels will also be displayed on the Full Disclosure page, and vice versa. Beat labels can be printed out.

15.2.7.5 Printing Event Reports
To print event reports via a printer, follow this procedure:

1. Enter the events review page.
2. Select ♦ to enter the Print Setup dialog.
3. Select the desired options.
   - Print All Event List: print the entire event list.
   - Print List of Selected Events: print the list of selected events.
   - Print Detail of Selected Events: print the details of selected events.
   - Print Displayed Event Detail: print the waveforms and parameters of the currently displayed event.
4. Select Print.

15.2.8 Full Disclosure Review Page
You can review up to 48-hours of waveform data on the full disclosure review page. To enter the full disclosure review page, select the Main Menu quick key → from the Review column select Full Disclosure.

15.2.8.1 Selecting Waveforms
You can select the waveforms to be displayed and stored. Up to 48 hours of waveforms for all parameters can be stored. When closing the Select Waveform dialog, a prompt will inform you of the duration of waveforms that can be saved if the amount is less than 48 hours. To save and display the desired waveforms, follow this procedure:

1. Enter the full disclosure review page.
2. Select ♦ and select Setup to enter the Select Waveform page.
3. Select the Storage tab and set the desired waveforms to be stored in the monitor. Select the Display (Maximum: 3) tab and set the desired waveforms to be displayed on the Full Disclosure page.

NOTE
• Storing more waveforms may shorten the storage time to less than 48 hours. Please adjust the waveforms stored with this consideration.

In case of alarms, the background of the compressed waveform is highlighted with a colored block during the alarm time:

- Red: high alarm priority
Yellow: medium alarm priority
Cyan: low alarm priority

15.2.8.2 Setting Scale and Duration
To set the length and size of displayed compressed waveforms, follow this procedure:
1. Enter the full disclosure review page.
2. Select the Overview button. If there is no Overview button in the Full disclosure page, skip this step.
3. Set the waveforms scale in either of the following ways:
   ◆ Select \[ \text{***} \] and select Scale.
   ◆ Select waveform label.
4. Select Duration to set the length of displayed waveforms.

15.2.8.3 Viewing Details of Compressed Waveforms
To view the full waveforms and numeric values, follow this procedure:
1. Enter the full disclosure review page.
2. Select Detail.
You can perform the following operations on the this page:
   ■ Switch on Beat Anno. For more information, see 15.2.7.4 Viewing Event Details.
   ■ Select \[ \text{***} \] to make the following settings:
     ◆ Select Speed and ECG Gain.
     ◆ Select Save As Event, and edit according to prompt to save current waveform as an event.
     ◆ Select Overview to switch to the compressed waveform view.

15.2.8.4 Printing the Full Disclosure Waveform Report
To print a compressed waveform report, follow this procedure:
1. Enter the full disclosure review page.
2. Select \[ \text{***} \] to enter the Print Setup dialog.
3. Select waveform type you want to print:
   ◆ Print Waveform Overview: compressed waveform of selected period will be printed. This option is only available when printing from the Overview or compressed waveform view.
   ◆ Print Displayed Waveform Detail: parameter values and all stored waveforms around the cursor time will be printed. This option is only available when printing from the Detail view.
4. Select Print.

15.2.9 OxyCRG Review Page (available for the independent external display)
You can review up to 48 hours of trend curves on the OxyCRG review page. The OxyCRG review functionality is available for neonatal monitoring only.

NOTE
  • OxyCRG Review Page is available only when Patient Category is set to Neo.

15.2.9.1 Entering the OxyCRG Review Page
Choose one of the following methods to enter the OxyCRG review page:
   ◆ From the OxyCRG screen, select the ABD events list area.
   ◆ Select the Review quick key \( \rightarrow \) select the OxyCRG tab.
Select the Main Menu quick key → from the Review column select OxyCRG.

### 15.2.9.2 The Display of the OxyCRG Review Page

The following figure shows the OxyCRG screen:

1. Event title area: displays information of the selected event, such as the event type and time.
2. Event detail area: displays parameter trends, compressed waveform, and parameter values of selected event.
3. Event summary area: displays ABD events within the Zoom period. The selected event is enclosed in a white frame.
4. Event statistics area: displays the total number of ABD events and the numbers of each event within the Zoom period.

### 15.2.9.3 Changing the Resolution of Trend Curves

To set the resolution of trend curves, follow this procedure:

1. Enter the OxyCRG review page.
2. Set Zoom.

**NOTE**

If the Zoom is set for a large duration (for example, 8 hrs), the screen may show "No Patient Data" for the first several minutes of data collection (for example, 6 minutes), but data will be shown after enough data has been collected.

### 15.2.9.4 Printing an OxyCRG Review Report

To print an OxyCRG review report, follow this procedure:

1. Enter the OxyCRG review page.
2. Select to enter the Print Setup dialog.
3. Select Print. The report duration corresponds to the duration of data shown on the screen.

### 15.2.10 12-Lead ECG Review Page

When 12-lead ECG analysis is performed, you can review the most recent 20 events of 12-lead analysis. For more information, see 8 Resting 12-Lead ECG Analysis.

#### 15.2.10.1 Entering the 12-Lead Review Page

Choose one of the following methods to enter the 12-lead ECG review page:
Upon completion of 12-lead ECG analysis, select **Review** from the **12-Lead Interpretation** page. For more information, see 8 Resting 12-Lead ECG Analysis.

Select the **Main Menu** quick key → from the **Review** column select **12-Lead ECG**.

### 15.2.10.2 Switching to Median Complex

The median complex template displays 12-lead ECG waveforms on one page in 4 columns, with 3 lines in each column, and one rhythm lead waveform at the bottom. Additionally, a short vertical bar appears above each waveform, marking the start and end positions of the P-wave and the QRS-wave and the end position of the T-wave.

To view Median Complex, follow this procedure:

1. Enter the 12-lead review page.
2. Select **Median Complex**.
3. Selecting **Waveform** can return to the 12-lead ECG waveform page.

### 15.2.10.3 Setting 12-Lead ECG Waveforms

To set the 12-lead ECG waveforms on the review page, follow this procedure:

1. Enter the 12-lead review page.
2. Set **Speed**, **Gain**, and **Layout**.

### 15.2.10.4 Printing the 12-Lead ECG Report

To print the 12-Lead ECG report, follow this procedure:

1. Enter the 12-lead review page.
2. Select **Print**.
3. Configure the 12-lead ECG report.
4. Select **Print**.

### 15.3 Reviewing Discharged Patients

For discharged patients, you can review the trend data in the review page. You can also review the events and 12-lead ECG analysis results.

#### 15.3.1 Checking the Data of a Discharged Patient

1. Access the **Discharged Patients** dialog box by selecting the **Main Menu** quick key → from the **Patient Management** column select **Discharged Patients**.
2. From the patient list select the desired patient.
3. Select **Detail**.

#### 15.3.2 Checking the Information of a Discharged Patient

1. Access the **Discharged Patients** dialog box by selecting the **Main Menu** quick key → from the **Patient Management** column select **Discharged Patients**.
2. From the patient list select the desired patient.
3. Select **Detail**.
4. Select the icon to enter the **Patient Management** dialog box.
5. Select **OK** to exit the **Patient Management** dialog box.
This page intentionally left blank.
Clinical Assistive Applications (CAA) (only available when the N1 is used with the independent external display)

The Clinical Assistive Applications (CAA) function integrates some commonly used clinical guidelines and tools into the monitor. It puts the currently monitoring parameter measurements together and provides comprehensive analysis results.

CAA can improve the clinician's working efficiency. However, it is not directly used for diagnosis and cannot not replace the clinician's judgement.

16.1 Early Warning Score (EWS)

The Early Warning Score (EWS) can help you recognize the early sign of deterioration in patients based on vital signs and clinical observations. Depending on the score calculated, appropriate recommendations are displayed.

The monitor supports the following scores:

- MEWS (Modified Early Warning Score)
- NEWS (National Early Warning Score)
- NEWS2 (National Early Warning Score 2)
- Custom Score

A subscore is given for each parameter based on the measured or entered value. When all the required parameters are entered or measured, the subscores are added together to calculate the total early warning score. Each subscore has a color coding to indicate associated level of risk. When the total score is outside of the thresholds, actions are recommended. Both MEWS and NEWS give total scores.

Custom Score is based on user-defined parameters.

MEWS and NEWS and NEWS2 are intended for adult patients only. The patient category of the Custom Score is defined by the Mindray Clinical Score Configuration Tool. For more information, see Mindray Clinical Scoring Config Tool Instruction for Use (P/N: 046-012986-00).

WARNING

- The default settings for IPS and Custom Scoring are based on the scoring system used by MEWS and NEWS, which have only been clinical validated in the adult population. If you choose to use this feature for pediatric patients, you may need to customize the scoring system to reflect any relevant differences between adult and pediatric patients.
- The EWS scores and recommended actions are for reference only and cannot be directly used for diagnostic interpretation.
- EWS cannot be used as an prognosis index. It is not a clinical judgement tool. Clinicians must use their clinical judgement in conjunction with the EWS tool at all times.
- MEWS and NEWS are intended for adult patients only. NEWS is not applicable to pregnant woman and COPD (Chronic Obstructive Pulmonary Disease) patients.

NOTE

- The EWS scores does not trigger any alarms, and cannot used for continuous monitoring.

16.1.1 Displaying the EWS Numerics Area

To display the EWS numerics area, follow this procedure:
1. Access **Tile Layout** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Tile Layout**.

2. Select the parameter area where you want to display the EWS score, and then from the popup list select **EWS**.

   ![EWS Screen Diagram]

   1. EWS label
   2. Total score. The color of the circle indicates the level of risk.
   3. Single parameter whose score reaches 3
   4. Latest history total score
   5. Risk level indicator. The level of risk increases from top down.
   6. Scoring interval
   7. The scoring time
   8. Scoring countdown: time to the next scoring.

### 16.1.2 Accessing the EWS Screen

Access the EWS window in any of the following ways:

- Select the EWS parameter area
- Select the **EWS** quick key.
- Select the **Screen Setup** quick key → select the **Choose Screen** tab → select **EWS**.
- Select the **Main Menu** quick key → from the **CAA** column select **EWS**.

Take NEWS2 as an example, the EWS screen is shown as follows. Your screen may be slightly different due to the configuration.
16.1.3 Performing EWS Scoring

To perform scoring, follow this procedure:

1. Select **Reset** to clear the previous score and update values of currently monitored parameters and relevant subscores.

2. For NEWS2, set the **SpO2 Scale**.
   - **Scale 1**: for patient without hypercapnic respiratory failure.
   - **Scale 2**: for patients with a prescribed oxygen saturation requirement of 88–92% (for example, in patients with hypercapnic respiratory failure).

3. Measure or manually enter other required parameters and observations.

4. If enabled, select the operator ID.
5. Select **Calculate** to get the total score.

6. If **Score Confirmation** is enabled, select **Confirm** to save current scoring, or select **Cancel** to give up current scoring. Refer to section 16.1.4.2 Setting the Scoring Confirmation Switch for more information.

**CAUTION**

- The decision to use Scale 2 of the SpO2 Scale should be made by a competent clinical decision maker and should be recorded in the patient’s clinical notes.

**NOTE**

- Before calculating the score, select Reset to clear the previous score.
- The keyboard symbol at the right of the parameter value indicates that the value is manually entered.
- You can get the score only when all required parameters have been measured or entered.

### 16.1.4 Changing EWS Settings

#### 16.1.4.1 Changing the Scoring Protocol

The monitor is configured with a default scoring protocol. To change the scoring protocol, follow this procedure:

1. From the EWS page select **Setup**.
2. Set **Score**.

#### 16.1.4.2 Setting the Scoring Confirmation Switch

To select if confirmation is required before saving score, follow this procedure:

1. From the EWS page select **Setup**.
2. Set **Scoring Confirmation** switch.
   - Off: the monitor automatically saves the scoring result after the scoring is completed.
   - On: you need to confirm that whether the scoring result is saved or not after the scoring is completed.

#### 16.1.4.3 Setting the Manual Data Timeout

The manually input parameter data become invalid after a preset time. To set the timeout period for the input data, follow this procedure:

1. From the EWS screen select **Setup**.
2. From the **Manual Data Timeout** area, select a desired parameter and set its timeout period.

**NOTE**

- If the data is expired and not updated, the monitor displays the corresponding parameter score in outline font, and gives a timeout alarm.

#### 16.1.4.4 Setting Auto Scoring

The monitor automatically starts scoring at the preset interval. To enable auto scoring, follow this procedure:

1. From the EWS page select **Setup**.
2. Set **Auto Scoring**:
   - **Interval**: the monitor automatically starts scoring at the preset interval.
   - **NIBP**: the monitor automatically starts scoring at the completion of each NIBP measurement.
   - **Alarm**: the monitor automatically starts scoring when an alarm occurs to the parameter for scoring.
   - If no option is selected, the monitor does not initiate auto scoring.
16.1.4.5 Setting Auto Scoring Interval
1. From the EWS page select Setup.
2. Set Interval:
   - By Score: the monitor automatically starts scoring as per the interval selected for corresponding total score.
   - 5 min - 24 h: If Auto Scoring is set to Interval, the monitor automatically starts scoring as per the selected interval. If Auto Scoring is not set to Interval, the countdown timer of manual scoring is selected.

16.1.4.6 Managing Operator ID
To manage the Operator ID, follow this procedure:
1. From the EWS page select Setup.
2. Select the Manage Operator ID button at the bottom left corner to add or delete the operator IDs.

**NOTE**
- Manage Operator ID button is available when it is enabled in the Maintenance menu. For more information, see section 21.4.1.1 Displaying and Managing the Operator ID.

16.2 Glasgow Coma Scale (GCS)
The Glasgow Coma Scale (GCS) function is based on Teasdale's Assessment of Coma and Impaired Consciousness - A Practical Scale (Lancet, 1974). Three aspects of behavior are independently measured: eye opening, verbal response, and motor response. The scores are added together to indicate that patient's level of consciousness.

GCS is intended for adults and pediatric patients.

**CAUTION**
- GCS is for reference only. Consult other clinical observations for diagnosis.
- GCS is not applied to patients that are sedated, musically relaxed, with artificial airway, drunk, hypothermia or in status epilepsies.
- Please refer to hospital policy regarding acceptable use of GCS.
- When applied to children younger than five years old or to the elderly, the GCS score may not reflect actual function.

16.2.1 Displaying the GCS Parameter Area
To display the GCS parameter area, follow this procedure:
1. Access Tile Layout in either of the following ways:
   - Select the Screen Setup quick key → select the Tile Layout tab.
   - Select the Main Menu quick key → from the Display column select Tile Layout.
2. Select the parameter area where you want to display the GCS score, and then from the popup list select GCS.

The following figure shows the GCS parameter area. The display may be configured to look slightly different.
16.2.2 Accessing the GCS Dialog
Enter the GCS dialog in any of the following ways:
- Select the GCS parameter area.
- Select the GCS quick key.
- Select the Main Menu quick key → from the CAA column select GCS.

16.2.3 Performing GCS Scoring
To perform scoring, follow this procedure:
1. From the Eye Opening area, Verbal Response area, and Motor Response area, respectively select an item that represents the patient’s status.
2. Select OK to accept the total score.
The following table lists the default score range and color of relevant consciousness level.

<table>
<thead>
<tr>
<th>Level</th>
<th>Range</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild damage</td>
<td>13-15</td>
<td>White</td>
</tr>
<tr>
<td>Moderate damage</td>
<td>9-12</td>
<td>Yellow</td>
</tr>
<tr>
<td>Severe damage</td>
<td>3-8</td>
<td>Red</td>
</tr>
</tbody>
</table>

**NOTE**

- The GCS score range is adjustable. Refer to 21.4.2 Setting GCS Threshold for Each Consciousness Level for the method of changing the high limit and low limit of each consciousness level.

### 16.2.4 Setting GCS Scoring Interval

From the *GCS* dialog, select *Interval* to set GCS scoring interval. When the scoring interval is reached and you do not perform another scoring, the score will be invalidated and displayed as outline fonts.

### 16.2.5 Reviewing GCS Trend Data

From the *GCS* dialog, select *Review* to enter the *Review* dialog and view the GCS trend data from the *Tabular Trends*.
This page intentionally left blank.
17 Calculation (only available when the N1 is used with the independent external display)

17.1 Calculation Overview

The monitor provides calculation functions. The calculated values, which are not directly measured, are computed based on the values you provide. The calculation function is independent of other monitoring functions and can therefore be used for patients being monitored by other monitors. Any operation in a calculation dialog does not affect the patient monitored by the current monitor.

You can perform the following calculations:

- Drug calculations
- Hemodynamic calculations
- Oxygenation calculations
- Ventilation calculations
- Renal calculations

17.2 Calculation Safety Information

**WARNING**

- Decisions on the choice and dosage of drugs administered to patients must always be made by the physician in charge. The drug calculations are based on the values input; it does not check the plausibility of the calculation performed.
- Check that the entered values are correct and the calculated values are appropriate. Mindray assumes no responsibility for any consequences caused by wrong entries and improper operations.

17.3 Drug Calculations

17.3.1 Performing Drug Calculations

To perform drug calculations, follow this procedure:

1. Access the drug calculator by either of the following ways:
   - Select the Calculations quick key → select the Drug tab.
   - Select the Main Menu quick key → from the Calculations column select Drug.

2. Set Drug Name and Patient Category. If the dose of drug is weight dependent, you must input the patient’s weight. The dose calculation program has a library of commonly used drugs, while Drug A through Drug E are user defined.

3. Enter the known values, for example Drug Amount and Solution Volume.

4. Select Calculate. The calculated values are indicated by red arrows.

**NOTE**

- If available, the patient category and weight from the Patient Demographics dialog are automatically entered when you first access drug calculation. You can change the patient category and weight. This will not change the patient category and weight stored in the patient demographic information.
17.3.2 Checking the Titration Table

The titration table shows information on the currently used drugs. Use the titration table to see what dose of a drug your patient will receive at different infusion rates. To access the titration table, follow this procedure:

1. Access drug calculator by either of the following ways:
   ◆ Select the **Calculations** quick key.
   ◆ Select the **Main Menu** quick key → from the **Calculations** column select **Drug**.
2. Select the **Titration Table** tab.
3. Select **Dose Type** to set the type of dose unit in the titration table.
4. Select **Interval** to set the interval between two adjacent titration table items.

You can select how to display the titration table:

- **Dose**: the titration table is listed in the sequence of increased drug dose.
- **Infusion Rate**: the titration table is listed in the sequence of increased infusion rate. By default the resolution of the infusion rate is one (1). By selecting **Exact Rate** the resolution of the infusion rate can reach 0.01 so that you can display the infusion rate more accurately.

17.3.3 Drug Calculation Formula

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose</td>
<td>Dose/hr, Dose/min</td>
<td>Dose = Infusion Rate × Concentration</td>
</tr>
<tr>
<td>Dose (weight based)</td>
<td>Dose/kg/hr, Dose/kg/min</td>
<td>Dose (weight based) = Infusion Rate × Concentration/Weight</td>
</tr>
<tr>
<td>Drug Amount</td>
<td>g series: mcg, mg, g unit series: Unit, KU, MU mEq series: mEq</td>
<td>Drug Amount = Dose × Duration</td>
</tr>
<tr>
<td>Drug Amount (weight based)</td>
<td>g series: mcg, mg, g unit series: Unit, KU, MU mEq series: mEq</td>
<td>Drug Amount (weight based) = Dose × Duration × Weight</td>
</tr>
<tr>
<td>Duration</td>
<td>hr</td>
<td>Duration = Amount/Dose</td>
</tr>
<tr>
<td>Duration (weight based)</td>
<td>hr</td>
<td>Duration (weight based) = Amount/(Dose × Weight)</td>
</tr>
<tr>
<td>Concentration</td>
<td>mcg/ml, mg/ml, g/ml, Unit/ml, KU/ml, MU/ml, mEq/ml</td>
<td>Concentration = Drug Amount/Solution Volume</td>
</tr>
<tr>
<td>Solution volume</td>
<td>ml</td>
<td>Volume = Infusion Rate × Duration</td>
</tr>
<tr>
<td>Infusion rate</td>
<td>ml/hr</td>
<td>Infusion Rate = Dose/Concentration</td>
</tr>
<tr>
<td>Infusion rate (weight based)</td>
<td>g/ml/hr</td>
<td>Infusion Rate = Dose × Weight/Concentration</td>
</tr>
</tbody>
</table>

17.3.4 Titration Table Calculation Formula

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infusion Rate</td>
<td>ml/hr</td>
<td>Infusion Rate = Dose/Concentration</td>
</tr>
<tr>
<td>Infusion Rate (weight based)</td>
<td>ml/hr</td>
<td>Infusion Rate = Weight × Dose/Concentration</td>
</tr>
<tr>
<td>Dose</td>
<td>Dose/hr, Dose/min</td>
<td>Dose = Infusion Rate × Concentration</td>
</tr>
<tr>
<td>Dose (weight based)</td>
<td>Dose/kg/hr, Dose/kg/min</td>
<td>Dose (weight based) = Infusion Rate × Concentration/Weight</td>
</tr>
</tbody>
</table>
17.4 **Hemodynamic Calculations**

The monitor provides the hemodynamic calculation function and can save the results of up to 10 calculations, which are displayed in groups.

17.4.1 **Performing Hemodynamic Calculations**

To perform hemodynamic calculation, follow this procedure:

1. Access hemodynamic calculation by either of the following ways:
   - Select the **Calculations** quick key → **Hemodynamics** tab.
   - Select the **Main Menu** quick key → from the **Calculations** column select **Hemodynamics**.
2. Enter the known values. For a patient who is being monitored, the currently measured values are automatically entered.
3. Select **Calculate**.
   
   A calculated value greater than the normal upper limit is indicated by an up arrow “↑”. A calculated value lower than the normal lower limit is indicated by a down arrow “↓”.

You can select **Range** to show the normal range of each parameter.

17.4.2 **Input Parameters for Hemodynamic Calculations**

<table>
<thead>
<tr>
<th>Input Parameter</th>
<th>Label</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>cardiac output</td>
<td>C.O.</td>
<td>L/min</td>
</tr>
<tr>
<td>heart rate</td>
<td>HR</td>
<td>bpm</td>
</tr>
<tr>
<td>pulmonary artery wedge pressure</td>
<td>PAWP</td>
<td>mmHg</td>
</tr>
<tr>
<td>mean arterial pressure</td>
<td>MAP</td>
<td>mmHg</td>
</tr>
<tr>
<td>pulmonary artery mean pressure</td>
<td>PA-M</td>
<td>mmHg</td>
</tr>
<tr>
<td>central venous pressure</td>
<td>CVP</td>
<td>mmHg</td>
</tr>
<tr>
<td>end-diastolic volume</td>
<td>EDV</td>
<td>ml</td>
</tr>
<tr>
<td>height</td>
<td>Height</td>
<td>cm</td>
</tr>
<tr>
<td>weight</td>
<td>Weight</td>
<td>kg</td>
</tr>
</tbody>
</table>

**NOTE**

- If you enable Use PA-D as PAWP, PA-D value will be used to replace PAWP value for hemodynamic calculation. For more information, refer to 13.5.8 Setting the Use PA-D as PAWP Switch (only available when the N1 is used with the independent external display).

17.4.3 **Calculated Parameters and Formulas for Hemodynamic Calculations**

<table>
<thead>
<tr>
<th>Calculated Parameters</th>
<th>Label</th>
<th>Unit</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>cardiac index</td>
<td>C.I.</td>
<td>L/min/m²</td>
<td>( \text{C.I. (L/min/m²)} = \frac{\text{C.O. (L/min)}}{\text{BSA (m²)}} )</td>
</tr>
<tr>
<td>body surface area</td>
<td>BSA</td>
<td>m²</td>
<td>( \text{BSA (m²)} = \text{Wt}^{0.425} \times \text{Ht}^{0.725} \times 0.007184 )</td>
</tr>
<tr>
<td>stroke volume</td>
<td>SV</td>
<td>ml</td>
<td>( \text{SV (ml)} = 1000 \times \frac{\text{C.O. (L/min)}}{\text{HR (bpm)}} )</td>
</tr>
<tr>
<td>stroke index</td>
<td>SVI</td>
<td>ml/m²</td>
<td>( \text{SVI (ml/m²)} = \frac{\text{SV (ml)}}{\text{BSA (m²)}} )</td>
</tr>
<tr>
<td>systemic vascular resistance</td>
<td>SVR</td>
<td>DS/cm⁵</td>
<td>( \text{SVR (DS/cm⁵)} = 79.96 \times \frac{\text{APMAP (mmHg)} \cdot \text{CVP (mmHg)}}{\text{C.O. (L/min)}} )</td>
</tr>
</tbody>
</table>
17.5 Oxygenation Calculations

The monitor provides the oxygenation calculation function and can save the results of up to 10 calculations, which are displayed in groups.

17.5.1 Performing Oxygenation Calculations

To perform oxygenation calculations, follow this procedure:

1. Access oxygenation calculation by either of the following ways:
   - Select the Calculations quick key → Oxygenation tab.
   - Select the Main Menu quick key → from the Calculations column select Oxygenation.

2. Enter the known values. For a patient who is being monitored, the currently measured values are automatically entered.

3. Select Calculate.

A calculated value greater than the normal upper limit is indicated by an up arrow “↑”. A calculated value lower than the normal lower limit is indicated by a down arrow “↓”.

In the Oxygenation page, you can also perform the following operations:

- Select Oxycont Unit, Hb Unit, and Pressure Unit. Then corresponding parameter values will be automatically converted and updated accordingly.
- Select Range to show the normal range of each parameter.

<table>
<thead>
<tr>
<th>Calculated Parameters</th>
<th>Label</th>
<th>Unit</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>systemic vascular resistance index</td>
<td>SVRI</td>
<td>DS-m²/cm³</td>
<td>SVRI (DS-m²/cm³) = SVR (DS/cm³) × BSA (m²)</td>
</tr>
<tr>
<td>pulmonary vascular resistance</td>
<td>PVR</td>
<td>DS/cm⁵</td>
<td>PVR (DS/cm⁵) = 79.96 × [PAMAP (mmHg) - PAWP (mmHg)] / C.O. (L/min)</td>
</tr>
<tr>
<td>pulmonary vascular resistance index</td>
<td>PVRI</td>
<td>DS-m²/cm³</td>
<td>PVRI (DS-m²/cm³) = PVR (DS/cm³) × BSA (m²)</td>
</tr>
<tr>
<td>left cardiac work</td>
<td>LCW</td>
<td>kg·m</td>
<td>LCW (kg·m) = 0.0136 × APMAP (mmHg) × C.O. (L/min)</td>
</tr>
<tr>
<td>left cardiac work index</td>
<td>LCWI</td>
<td>kg·m/m²</td>
<td>LCWI (kg·m/m²) = LCW (kg·m)/BSA (m²)</td>
</tr>
<tr>
<td>left ventricular stroke work</td>
<td>LVSW</td>
<td>g·m</td>
<td>LVSW (g·m) = 0.0136 × APMAP (mmHg) × SV (ml)</td>
</tr>
<tr>
<td>left ventricular stroke work index</td>
<td>LVSWI</td>
<td>g·m/m²</td>
<td>LVSWI (g·m/m²) = LVSW (g·m)/BSA (m²)</td>
</tr>
<tr>
<td>right cardiac work</td>
<td>RCW</td>
<td>kg·m</td>
<td>RCW (kg·m) = 0.0136 × APMAP (mmHg) × C.O. (L/min)</td>
</tr>
<tr>
<td>right cardiac work index</td>
<td>RCWI</td>
<td>kg·m/m²</td>
<td>RCWI (kg·m/m²) = RCW (kg·m)/BSA (m²)</td>
</tr>
<tr>
<td>right ventricular stroke work</td>
<td>RVSW</td>
<td>g·m</td>
<td>RVSW (g·m) = 0.0136 × APMAP (mmHg) × SV (ml)</td>
</tr>
<tr>
<td>right ventricular stroke work index</td>
<td>RVSWI</td>
<td>g·m/m²</td>
<td>RVSWI (g·m/m²) = RVSW (g·m)/BSA (m²)</td>
</tr>
<tr>
<td>ejection fraction</td>
<td>EF</td>
<td>%</td>
<td>EF (%) = 100 × SV (ml)/EDV (ml)</td>
</tr>
<tr>
<td>end-diastolic volume index</td>
<td>EDVI</td>
<td>ml/m²</td>
<td>EDVI (ml/m²) = EDV (ml)/BSA (m²)</td>
</tr>
<tr>
<td>end-systolic volume</td>
<td>ESV</td>
<td>ml</td>
<td>ESV (ml) = EDV (ml) – SV (ml)</td>
</tr>
<tr>
<td>end-systolic volume index</td>
<td>ESVI</td>
<td>ml/m²</td>
<td>ESVI (ml/m²) = ESV (ml)/BSA (m²)</td>
</tr>
</tbody>
</table>
## 17.5.2 Input Parameters for Oxygenation Calculations

<table>
<thead>
<tr>
<th>Input Parameter</th>
<th>Label</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>cardiac output</td>
<td>C.O.</td>
<td>L/min</td>
</tr>
<tr>
<td>percentage fraction of inspired oxygen</td>
<td>FiO₂</td>
<td>%</td>
</tr>
<tr>
<td>partial pressure of oxygen in the arteries</td>
<td>PaO₂</td>
<td>mmHg, kPa</td>
</tr>
<tr>
<td>partial pressure of carbon dioxide in the arteries</td>
<td>PaCO₂</td>
<td>mmHg, kPa</td>
</tr>
<tr>
<td>arterial oxygen saturation</td>
<td>SaO₂</td>
<td>%</td>
</tr>
<tr>
<td>partial pressure of oxygen in venous blood</td>
<td>PvO₂</td>
<td>mmHg, kPa</td>
</tr>
<tr>
<td>venous oxygen saturation</td>
<td>SvO₂</td>
<td>%</td>
</tr>
<tr>
<td>hemoglobin</td>
<td>Hb</td>
<td>g/L, g/dL, mmol/L</td>
</tr>
<tr>
<td>respiratory quotient</td>
<td>RQ</td>
<td>None</td>
</tr>
<tr>
<td>atmospheric pressure</td>
<td>ATMP</td>
<td>mmHg, kPa</td>
</tr>
<tr>
<td>height</td>
<td>Height</td>
<td>cm, inch</td>
</tr>
<tr>
<td>weight</td>
<td>Weight</td>
<td>kg, lb</td>
</tr>
</tbody>
</table>

## 17.5.3 Calculated Parameters and Formulas for Oxygenation Calculations

<table>
<thead>
<tr>
<th>Calculated Parameters</th>
<th>Label</th>
<th>Unit</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>body surface area</td>
<td>BSA</td>
<td>m²</td>
<td>$\text{BSA (m²) = Wt^{0.425} (kg) × Ht^{0.725} (cm) × 0.007184}$</td>
</tr>
<tr>
<td>oxygen consumption</td>
<td>VO₂</td>
<td>ml/min</td>
<td>$\text{VO₂ (ml/min) = C(a-v)O₂ (ml/L) × C.O. (L/min)}$</td>
</tr>
<tr>
<td>arterial oxygen content</td>
<td>CaO₂</td>
<td>ml/L, ml/dl</td>
<td>$\text{CaO₂ (ml/L) = 10x (0.0134 × Hb (g/dl) × SaO₂ (g/dl)) + 0.031 × PaO₂ (mmHg)}$</td>
</tr>
<tr>
<td>venous oxygen content</td>
<td>CvO₂</td>
<td>ml/L, ml/dl</td>
<td>$\text{CvO₂ (ml/L) = 10x (0.0134 × Hb (g/dl) × SvO₂ (g/dl)) + 0.031 × PvO₂ (mmHg)}$</td>
</tr>
<tr>
<td>arteriovenous oxygen content difference</td>
<td>C(a-v)O₂</td>
<td>ml/L, ml/dl</td>
<td>$\text{C(a-v)O₂ (ml/L) = CaO₂ (ml/L) - CvO₂ (ml/L)}$</td>
</tr>
<tr>
<td>oxygen extraction ratio</td>
<td>O₂ER%</td>
<td>%</td>
<td>$\text{O₂ER (%) = 100 × C(a-v)O₂ (ml/L)/CaO₂ (ml/L)}$</td>
</tr>
<tr>
<td>oxygen transport</td>
<td>DO₂</td>
<td>ml/min</td>
<td>$\text{DO₂ (ml/min) = C.O. (L/min) × CaO₂ (ml/L)}$</td>
</tr>
<tr>
<td>partial pressure of oxygen in the alveoli</td>
<td>PAO₂</td>
<td>mmHg, kPa</td>
<td>$\text{PAO₂ (mmHg) = [ATMP (mmHg) - 47 mmHg] × FiO₂ (%) / 100 - PaCO₂ (mmHg) × [FiO₂ (%) / 100 + \text{RQ}]}$</td>
</tr>
<tr>
<td>alveolar-arterial oxygen difference</td>
<td>AaDO₂</td>
<td>mmHg, kPa</td>
<td>$\text{AaDO₂ (mmHg) = PAO₂ (mmHg) - PaO₂ (mmHg)}$</td>
</tr>
<tr>
<td>capillary oxygen content</td>
<td>CcO₂</td>
<td>ml/L, ml/dl</td>
<td>$\text{CcO₂ (ml/L) = Hb (g/L) × 1.34 + 0.031 × PAO₂ (mmHg)}$</td>
</tr>
<tr>
<td>venous admixture</td>
<td>QS/QT</td>
<td>%</td>
<td>$\text{QS/QT (%) = 100 × [1.34 × Hb (g/L) × (1 - SaO₂ (g/dl)/100) + 0.031 × (PaO₂ (mmHg) - PaO₂ (mmHg))]/(1.34 × Hb (g/L) × (1 - SvO₂ (g/dl)/100) + 0.031 × (PaO₂ (mmHg) - PvO₂ (mmHg))]}$</td>
</tr>
<tr>
<td>oxygen transport index</td>
<td>DO₂I</td>
<td>ml/min/m²</td>
<td>$\text{DO₂I (ml/min/m²) = CaO₂ (ml/L) × (C.O. (L/min)/BSA (m²))}$</td>
</tr>
<tr>
<td>oxygen consumption</td>
<td>VO₂I</td>
<td>ml/min/m²</td>
<td>$\text{VO₂I (ml/min/m²) = C (a-v) O₂ (ml/L) × (C.O. (L/min)/BSA (m²))}$</td>
</tr>
</tbody>
</table>
17.6 Ventilation Calculations

The monitor provides the ventilation calculation function and can save the results of up to 10 calculations, which are displayed in groups.

17.6.1 Performing Ventilation Calculations

To perform ventilation calculations, follow this procedure:

1. Access ventilation calculation by either of the following ways:
   - Select the **Calculations** quick key → **Ventilation** tab.
   - Select the **Main Menu** quick key → from the **Calculations** column select **Ventilation**.

2. Enter the known values. For a patient who is being monitored, the currently measured values are automatically taken. If the anesthesia machine or ventilator is connected, measured values for ventilation calculation are also automatically entered.

3. Select **Calculate**.

A calculated value greater than the normal upper limit is indicated by an up arrow “↑”. A calculated value lower than the normal lower limit is indicated by a down arrow “↓”.

On the **Ventilation** page, you can also perform the following operations:

- Select **Pressure Unit**. Then corresponding parameter values will be automatically converted and updated accordingly.
- Select **Range** to show the normal range of each parameter.

17.6.2 Input Parameters for Ventilation Calculations

<table>
<thead>
<tr>
<th>Input Parameter</th>
<th>Label</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>percentage fraction of inspired oxygen</td>
<td>FiO₂</td>
<td>%</td>
</tr>
<tr>
<td>respiration rate</td>
<td>RR</td>
<td>rpm</td>
</tr>
<tr>
<td>partial pressure of mixed expiratory CO₂</td>
<td>PeCO₂</td>
<td>mmHg, kPa</td>
</tr>
<tr>
<td>partial pressure of carbon dioxide in the arteries</td>
<td>PaCO₂</td>
<td>mmHg, kPa</td>
</tr>
<tr>
<td>partial pressure of oxygen in the arteries</td>
<td>PaO₂</td>
<td>mmHg, kPa</td>
</tr>
<tr>
<td>tidal volume</td>
<td>TV</td>
<td>ml</td>
</tr>
<tr>
<td>respiratory quotient</td>
<td>RQ</td>
<td>None</td>
</tr>
<tr>
<td>atmospheric pressure</td>
<td>ATMP</td>
<td>mmHg, kPa</td>
</tr>
</tbody>
</table>

17.6.3 Calculated Parameters and Formulas for Ventilation Calculations

<table>
<thead>
<tr>
<th>Calculated Parameters</th>
<th>Label</th>
<th>Unit</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>partial pressure of oxygen in the alveoli</td>
<td>PAO₂</td>
<td>mmHg, kPa</td>
<td>PAO₂ (mmHg) = [ATMP (mmHg) - 47 mmHg] × FiO₂ (%) / 100 - PaCO₂ (mmHg) × [FiO₂ (%) / 100 + (1 - FiO₂ (%) / 100) / RQ]</td>
</tr>
<tr>
<td>alveolar-arterial oxygen difference</td>
<td>AaDO₂</td>
<td>mmHg, kPa</td>
<td>AaDO₂ (mmHg) = PAO₂ (mmHg) - PaO₂ (mmHg)</td>
</tr>
<tr>
<td>oxygenation ratio</td>
<td>Pa/FiO₂</td>
<td>mmHg, kPa</td>
<td>Pa/FiO₂ (mmHg) = 100 × PaO₂ (mmHg) / FiO₂ (%)</td>
</tr>
<tr>
<td>arterial to alveolar oxygen ratio</td>
<td>a/AO₂</td>
<td>%</td>
<td>a/AO₂ (%) = 100 × PaO₂ (mmHg) / PAO₂ (mmHg)</td>
</tr>
<tr>
<td>minute volume</td>
<td>MV</td>
<td>L/min</td>
<td>MV (L/min) = [TV (ml) × RR (rpm)] / 1000</td>
</tr>
</tbody>
</table>
17.7 Renal Calculations

The monitor provides the renal calculation function and can save the results of up to 10 calculations, which are displayed in groups.

17.7.1 Performing Renal Calculations

To perform renal calculations, follow this procedure:

1. Access renal calculation by either of the following ways:
   - Select the Calculations quick key → select the Renal tab.
   - Select the Main Menu quick key → from the Calculations column select Renal.

2. Enter the known values.

3. Select Calculate.

   A calculated value greater than the normal upper limit is indicated by an up arrow “↑”. A calculated value lower than the normal lower limit is indicated by a down arrow “↓”.

   You can select Range to show the normal range of each parameter.

17.7.2 Calculated Parameters and Formulas for Renal Calculations

<table>
<thead>
<tr>
<th>Calculated Parameters</th>
<th>Label</th>
<th>Unit</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>volume of physiological dead space</td>
<td>Vd</td>
<td>ml</td>
<td>Vd (ml) = TV (ml) × (1 - PeCO\textsubscript{2} (mmHg)/PaCO\textsubscript{2} (mmHg))</td>
</tr>
<tr>
<td>physiologic dead space in percent of tidal volume</td>
<td>Vd/Vt</td>
<td>%</td>
<td>Vd/Vt (%) = 100 × Vd (ml)/TV (ml)</td>
</tr>
<tr>
<td>alveolar volume</td>
<td>VA</td>
<td>L/min</td>
<td>VA (L/min) = (TV (ml) - Vd (ml)) × RR (rpm)/1000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input Parameter</th>
<th>Label</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>urine potassium</td>
<td>URK</td>
<td>mmol/L</td>
</tr>
<tr>
<td>urinary sodium</td>
<td>URNa</td>
<td>mmol/L</td>
</tr>
<tr>
<td>urine</td>
<td>Urine</td>
<td>ml/24 hrs</td>
</tr>
<tr>
<td>plasm osmolality</td>
<td>Posm</td>
<td>mOsM/kgH\textsubscript{2}O</td>
</tr>
<tr>
<td>urine osmolality</td>
<td>Uosm</td>
<td>mOsM/kgH\textsubscript{2}O</td>
</tr>
<tr>
<td>serum sodium</td>
<td>SerNa</td>
<td>mmol/L</td>
</tr>
<tr>
<td>creatinine</td>
<td>Cr</td>
<td>μmol/L</td>
</tr>
<tr>
<td>urine creatinine</td>
<td>UCr</td>
<td>μmol/L</td>
</tr>
<tr>
<td>blood urea nitrogen</td>
<td>BUN</td>
<td>mmol/L</td>
</tr>
<tr>
<td>height</td>
<td>Height</td>
<td>cm</td>
</tr>
<tr>
<td>weight</td>
<td>Weight</td>
<td>kg</td>
</tr>
</tbody>
</table>
### Calculated Parameters and Formulas for Renal Calculations

<table>
<thead>
<tr>
<th>Calculated Parameters</th>
<th>Label</th>
<th>Unit</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>urine sodium excretion</td>
<td>URNaEx</td>
<td>mmol/24 hrs</td>
<td>URNaEx (mmol/24 hrs) = Urine (ml/24 hrs) × URNa (mmol/L)/1000</td>
</tr>
<tr>
<td>urine potassium excretion</td>
<td>URKEx</td>
<td>mmol/24 hrs</td>
<td>URKEx (mmol/24 hrs) = Urine (ml/24 hrs) × URK (mmol/L)/1000</td>
</tr>
<tr>
<td>sodium potassium ratio</td>
<td>Na/K</td>
<td>%</td>
<td>Na/K (%) = 100 × URNa (mmol/L)/URK (mmol/L)</td>
</tr>
<tr>
<td>clearance of sodium</td>
<td>CNa</td>
<td>ml/24 hrs</td>
<td>CNa (ml/24 hrs) = URNa (mmol/L) × Urine (ml/24 hrs)/SerNa (mmol/L)</td>
</tr>
<tr>
<td>creatinine clearance rate</td>
<td>Clcr</td>
<td>ml/min</td>
<td>Clcr (ml/min) = Urine (ml/24 hrs)/[Cr (μmol/L) × (BSA (m$^2$)/1.73) × 1440]</td>
</tr>
<tr>
<td>fractional excretion of sodium</td>
<td>FENa</td>
<td>%</td>
<td>FENa (%) = 100 × URNa (mmol/L) × Cr (μmol/L)/SerNa (mmol/L) × Urine (ml/24 hrs)</td>
</tr>
<tr>
<td>osmolar clearance</td>
<td>Cosm</td>
<td>ml/min</td>
<td>Cosm (ml/min) = Uosm (mOsm/kgH$_2$O) × Urine (ml/24 hrs)/[Posm (mOsm/kgH$_2$O) × 1440]</td>
</tr>
<tr>
<td>free water clearance</td>
<td>CH2O</td>
<td>ml/hr</td>
<td>CH2O (ml/hr) = Urine (ml/24 hrs) /[1 - Uosm (mOsm/kgH$_2$O)/Posm (mOsm/kgH$_2$O)]</td>
</tr>
<tr>
<td>urine to plasma osmolality ratio</td>
<td>U/P osm</td>
<td>None</td>
<td>U/P osm = Uosm (mOsm/kgH$_2$O)/Posm (mOsm/kgH$_2$O) /24</td>
</tr>
<tr>
<td>blood urea nitrogen creatinine ratio</td>
<td>BUN/Cr*</td>
<td>Mmol/L</td>
<td>BUN/Cr = 1000 × BUN (mmol/L)/Cr (μmol/L)</td>
</tr>
<tr>
<td>urine-serum creatinine ratio</td>
<td>U/Cr</td>
<td>None</td>
<td>U/Cr (mmol/L) = Urine (ml/24 hrs)/Cr (μmol/L)</td>
</tr>
</tbody>
</table>

*: BUN/Cr is a ratio under the unit of mol.
18 Printing

18.1 Supported Printer

The monitor can output patient reports via a connected network printer. The monitor supports the following printers:

- HP LaserJet Pro M202dw
- HP LaserJet Pro 400 M401n
- HP LaserJet P4015n
- HP LaserJet 600 M602
- HP LaserJet Enterprise M605
- HP LaserJet Enterprise M608n

**NOTE**

- For more details about the printer, refer to the document accompanying the printer. With product upgrades, the monitor may support additional printers without prior notice. If you have any doubts about the compatibility of the printer used with this monitor, contact Mindray.

18.2 End Case Reports

18.2.1 Printing the End Case Report

To print the end case report, choose one of the following ways:

- Select Print from the End Case Report menu.
- Select Print End Case Report when you discharge a patient.
- Select the End Case Report quick key (only available for the independent external display).

18.2.2 Setting a Report as An End Case Report

The following reports can be set as end case reports:

- Tabular Trends Report
- Graphic Trend Report
- Event Report
- 12-lead Interpretation
- Alarm Limits Report
- Realtime Report
- ECG Report

To set a report as an end case report, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **End Case Report**.
2. From the **Select Reports** page, select the checkbox before the desired report, for example **ECG Report**.

18.2.3 Setting the End Case Report

To set the end case report, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **End Case Report**.
2. From the Report Setup page, set the following end case reports:
   ◆ Select the Tabular Trends Report, Graphic Trends Report, Realtime Report, and ECG Report tab, and set these end case report by referring to section 18.6 Configuring Reports.
   ◆ Select the Event Report tab, and select the event that needs to be printed.
   ◆ Select the 12-Lead Interpretation tab, and set the switch of Median Complex, Measurements, Interpretation, or Interpretation Summary. For other settings, refer to section 18.6.1 Configuring ECG Reports.

### 18.2.4 Setting the End Case Report Period

To set the end case report print period, follow this procedure:

1. Select the Main Menu quick key → from the Report column select End Case Report.
2. From the Select Reports page, set the Period.

**NOTE**

- End case report print period is calculated from the patient discharged time to the configured period.
- Period setting is applicable to all of the end case reports.

### 18.3 Manually Starting a Printing Task

This section describes different methods for manually printing a report.

#### 18.3.1 Printing from the Screen

The button will be shown at the top of dialogs that have associated reports. If the button is gray, then there is not enough information to begin the report, or the printer has not been set up.

When the icon is white, pressing it opens a Print Setup dialog or starts printing a report. If the Print Setup dialog is entered, configure the report and press Print to start printing.

#### 18.3.2 Printing Realtime Reports

Select the Print quick key to print a realtime report. You can also print a realtime report from the Report Setup dialog. For more information, see 18.3.3 Printing Most Common Reports.

#### 18.3.3 Printing Most Common Reports

The following most common reports can be printed:

- ECG Report
- Realtime Report
- Tabular Trends Report
- Graphic Trend Report.

To print these reports, follow this procedure:

1. Select the Main Menu quick key → from the Report column select Report Setup.
2. Select the desired report tab.
3. Check the settings.
4. Select Print.

### 18.4 Automatically Printing Reports

When a parameter alarm switch is set to on and an alarm is triggered for this parameter, you can set the monitor to automatically print a Print on Alarm Report.

To do so, follow this procedure:
1. Access alarm related tabs such as the **Alarm** tab for a parameter in one of the following ways:
   - Select the parameter or waveform area of the desired parameter → select the **Alarm** tab.
   - Select the **Main Menu** quick key → from the **Parameters** column select **Setup** → select the desired parameter → select the **Alarm** tab.

2. Switch on **Alarm outputs** for desired parameters.

### 18.5 Stopping a Printing Task

To stop a printing task, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **Print Queue**.
2. Select desired printing tasks and then select **Delete**. Alternately, select **Delete All** to stop all the printing tasks.

### 18.6 Configuring Reports

This section focuses on how to configure ECG reports, realtime reports, tabular trends reports, and graphic trends reports.

#### 18.6.1 Configuring ECG Reports

To configure ECG reports, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **Report Setup**.
2. Select the **ECG Report** tab.
3. Set the desired options. The following table explains some of the less familiar options.

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Set the print speed of ECG waveforms</td>
<td><strong>25 mm/sec</strong>: prints 25 mm of ECG waveform per second. <strong>50 mm/sec</strong>: prints 50 mm of ECG waveform per second.</td>
</tr>
<tr>
<td>Auto Interval</td>
<td>Defines the spacing between the ECG waveforms on a printout</td>
<td><strong>On</strong>: automatically adjusts the space between waveforms to avoid overlapping. <strong>Off</strong>: each waveform area has the same size on a printout.</td>
</tr>
<tr>
<td>12-Lead Format</td>
<td>Select the format of 12-lead ECG waveforms on a printout.</td>
<td><strong>12×1</strong>: displays 12-lead ECG waveforms on one page in one column. <strong>6×2</strong>: displays 12-lead ECG waveforms on one page in two columns, with 6 lines in each column. <strong>6×2+1</strong>: displays 12-lead ECG waveforms on one page in two columns, with 6 lines in each column, and one rhythm lead waveform at the bottom. <strong>3×4+1</strong>: displays 12-lead ECG waveforms on one page in 4 columns, with 3 lines in each column, and one rhythm lead waveform at the bottom. <strong>3×4+3</strong>: displays 12-lead ECG waveforms on one page in 4 columns, with 3 lines in each column, and three rhythm lead waveforms at the bottom.</td>
</tr>
<tr>
<td>Rhythm Lead 1</td>
<td>Select the lead that will be used as Rhythm Lead 1, 2, or 3.</td>
<td>I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6</td>
</tr>
<tr>
<td>Rhythm Lead 2</td>
<td>Select the lead that will be used as Rhythm Lead 1, 2, or 3.</td>
<td></td>
</tr>
<tr>
<td>Rhythm Lead 3</td>
<td>Select the lead that will be used as Rhythm Lead 1, 2, or 3.</td>
<td></td>
</tr>
<tr>
<td>Format sequence</td>
<td>Select the recording method of ECG report generated by auto measurement</td>
<td><strong>Sequential</strong>: 12-lead ECG data are recorded sequentially and displayed in 3 lines and 4 columns with 2.5 seconds of ECG data for each column. <strong>Simultaneous</strong>: Record simultaneous 12-lead ECG data.</td>
</tr>
</tbody>
</table>

Note: **Auto Interval** is only enabled when **12×1** is selected for **12-Lead Format**.

Note: Rhythm Lead setting is only enabled when **6×2+1**, **3×4+1**, or **3×4+3** is selected for **12-Lead Format**.
NOTE

• When ECG Lead Set is set to 3-Lead, the ECG report cannot be printed.

18.6.2 Configuring Realtime Reports

To configure tabular realtime reports, follow this procedure:
1. Select the Main Menu quick key → from the Report column select Report Setup.
2. Select the Realtime Report tab.
3. Set the desired options. The following table explains some of the options.

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Waveform</td>
<td>Select the desired waveform to print</td>
<td>Current Waveforms: prints the realtime report for the currently displayed waveforms and all the currently measured parameter values.</td>
</tr>
</tbody>
</table>

18.6.3 Configuring Tabular Trends Reports

To configure tabular trends reports, follow this procedure:
1. Select the Main Menu quick key → from the Report column select Report Setup.
3. Set the desired options.

The following table explains some of the options.

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Select the time before which a tabular trends report will be printed</td>
<td>/</td>
</tr>
<tr>
<td>Period</td>
<td>Select the period during which a tabular trends report will be printed.</td>
<td>Auto: one page of a tabular trends before the current time will be printed at the selected Interval. All: all stored tabular trends will be printed at the selected Interval. 30 min to 96 hrs: 30 min to 96 hrs of tabular trends before the selected Time will be printed at the selected Interval.</td>
</tr>
<tr>
<td>Interval</td>
<td>Select the resolution of the tabular trends printed on a report.</td>
<td>NIBP, EWS, GCS: at an interval of acquiring the values of selected parameter (EWS and GCS are only available when the N1 is used with the independent external display). Auto: using the Interval setting of the Tabular Trends review page. 5 sec to 3 hrs: the tabular trends will be printed at the interval of 5 sec to 3 hrs.</td>
</tr>
<tr>
<td>Report Format</td>
<td>Select the printing principle.</td>
<td>Parameter Oriented: print one page span of report with parameters listed by row and time listed by column when Interval is set to Auto. Time Oriented: print one page span of report with time listed by row and parameter listed by column when Interval is set to Auto. Note that Interval on Auto only limits the number of rows or columns for Time. The report may have multiple pages to accommodate the number of parameters. To limit the parameters, change the Trend Group.</td>
</tr>
</tbody>
</table>
18.6.4 Configuring Graphic Trends Reports

To set graphic trends reports, follow this procedure:
1. Select the **Main Menu** quick key → from the **Report** column select **Report Setup**.
2. Select the **Graphic Trends Report** tab.
3. Set the desired options.

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Select the period during which a graphic trends report will be printed.</td>
<td><strong>Auto</strong>: one page of a graphic trends before the current time will be printed.&lt;br&gt;&lt;br&gt;<strong>All</strong>: all stored graphic trends will be printed.&lt;br&gt;&lt;br&gt;<strong>30 min to 96 hrs</strong>: 30 min to 96 hrs of graphic trends before the selected <strong>Time</strong> will be printed.</td>
</tr>
</tbody>
</table>

18.7 Viewing Printer Status

You can view the status of the most recent ten printing tasks in the **Print Queue** dialog. To view the status of printing tasks, follow this procedure:
1. Select the **Main Menu** quick key → from the **Report** column select **Print Queue**.
2. View the status of printing tasks in the **Print Queue** dialog.

Each printing task includes the following information:
- Print time
- Report title
- Printer name (when using the printer server) or IP address (when using the network printer)
- Printing status, for example, printing, failed, retrying, and waiting.

18.8 Printer Out of Paper

When the printer runs out of paper, the print request will remain incomplete. If there are too many print jobs that remain incomplete, then a printer error may occur. To resolve the error, install paper. Some print requests may be lost if the incomplete tasks overflow the printer buffer. Missing or lost reports must be recreated and printed.

To reduce risks of printer errors, maintain enough paper in the printer.

18.9 List of Reports

The monitor can output the following reports to the printer:

- Realtime reports
  - Realtime Report
  - Freeze Report
  - ECG Report (5-lead, 6-lead, 12-lead)
  - 12-Lead Interpretation Report (realtime)
  - Print on Alarm Report
  - Alarm Limits Report
  - Titration Table Report (only available when the N1 is used with the independent external display)
  - Hemodynamic Calculation Report (only available when the N1 is used with the independent external display)
  - Oxygenation Calculation Report (only available when the N1 is used with the independent external display)
  - Ventilation Calculation Report (only available when the N1 is used with the independent external display)
  - Renal Calculation Report (only available when the N1 is used with the independent external display)
- ST Report (Realtime)
- QT Report (Realtime)
- OxyCRG Report (only available when the N1 is used with the independent external display)
- PAWP Report (only available when the N1 is used with the independent external display)

**History reports**
- Tabular Trends Report
- Graphic Trends Report
- Event List Report
- Event Detail Report
- Full Disclosure Overview Report
- Full Disclosure Detail Report
- 12-Lead Review Interpretation Report (review)
- OxyCRG Report (review, and only available when the N1 is used with the independent external display)

**End Case Report**
- End Case Report - Realtime Report
- End Case Report - ECG Report
- End Case Report - Tabular Trends Report
- End Case Report - Graphic Trends Report
19 Using the On-Screen Timers

The monitor has a Timer function to notify you when a preset time period is expired or how much time has elapsed. You can simultaneously display up to four timers.

19.1 Displaying Timers

To display a timer, follow this procedure:

1. Access Tile Layout in either of the following ways:
   - Select the Screen Setup quick key → select the Tile Layout tab.
   - Select the Main Menu quick key → from the Display column select Tile Layout.

2. Click the numeric tile area where the timer is to be displayed, and then select a timer from the popup list.

19.2 Controlling the Timer

The timer provides the following controls, depending on the state and settings of the timer:

- **Start**: starts the timer.
- **Pause**: pauses the timer.
- **Resume**: resumes the timer.
- **Reset**: clears the timer.

19.3 Setting the Timer

You can set each timer independently. To set the timer, follow this procedure:

1. Select the timer area to enter the Timer Setup dialog.
2. Set **Timer Type**:
   - **Normal**: The timer has a single and defined run time, and stops with a notification beep when the run time is reached.
   - **Advanced**: The timer has a single and defined run time. When the run time is reached, the timer makes a notification beep and continuously displays the time beyond the end of run time.
   - **Cycled**: The timer has a single and defined run time. When the run time is reached, the timer makes a notification beep and restarts automatically. The number of elapsed cycles is also displayed on the left of the Timer tile.
   - **Unlimited**: The timer displays the time elapsed since the timer was started.
   - **Clock**: The timer displays the system time.
3. Set **Direction**.
   - **Down**: the timer counts down, from Run Time to zero.
   - **Up**: the timer counts up, from zero to Run Time.
4. Set **Run Time**.
5. Set **Reminder Volume**.

A progress bar is shown with the run time. When the remaining time is 10 seconds, the monitor issues a reminder tone and the timer flashes in red, prompting you that the run time is about to expire.

**NOTE**

- You cannot change timer settings, other than Reminder Volume when a timer is running.
- You can set Direction, Run Time, and Reminder Volume only for normal, advanced, and cycled timers.
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# 20 Managing Configurations

## 20.1 Configuration Introduction

When performing continuous monitoring on a patient, the clinical professional often needs to adjust the monitor's settings according to the patient's condition. The collection of all these settings is called a configuration. The system configuration items can be classified as: parameter configuration items, conventional configuration items, and user maintenance items. Allowing you to configure the monitor more efficiently, the monitor provides different sets of configurations to accommodate the varying patient categories and departments. You can change some settings from a certain set of configuration and then save the changed configuration as a user configuration.

The default configurations provided for your monitor are department-oriented. You can choose either from:

- General
- OR
- ICU
- Neonatology
- CCU

Each department has three different sets of configurations tailored for adult, pediatric and neonatal patients respectively.

### WARNING

- The configuration management function is password protected. The configuration management tasks must be performed by clinical professionals.

## 20.2 Changing the Department

If the current department configuration is not the one you want to view, you can change the department by following this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select .
2. Select **Change Department**.
3. Select a department.
4. Select **OK**.

### CAUTION

- Changing the department will delete all current user configurations.

## 20.3 Setting Default Patient Category

To set the default patient category when admitting a new patient, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select .
2. Set **Default Patient Category**.

## 20.4 Setting Default Configuration

The monitor will load the pre-set default configuration in the following cases:
A patient is admitted.
A patient is discharged.
Patient category is changed.

To set the default configuration, follow this procedure:
1. Select the Main Menu quick key → from the Configuration column select Manage → input the required password → Select.
2. Select Select Default Config.
3. Select Load the Latest Config or Load Specified Config.
   ◆ When you select Load Specified Config, the restored configuration is subject to the patient category (adult, pediatric or neonate). This configuration can be either factory configuration or a saved user configuration. As an example, select Default Adult Config and then select Factory Default or user configuration(s).
   ◆ When you select Load the Latest Config, the latest configuration is loaded when the monitor is started or a patient is admitted.

20.5 Saving Current Settings

Current settings can be saved as a user configuration. Up to 25 user configurations can be saved.

To save current settings, follow this procedure:
1. Select the Main Menu quick key → from the Configuration column select Manage → input the required password → Select.
2. Select Save Current Settings.
3. Input the configuration name.
4. Select OK to save current settings as a user configuration.

20.6 Deleting a Configuration

To delete a configuration, follow this procedure:
1. Select the Main Menu quick key → from the Configuration column select Manage → input the required password → Select.
2. Select Delete Configuration.
3. Select the configuration you want to delete:
   ◆ In the Delete Configuration dialog, selecting Local tab shows the existing user configurations on the monitor.
   ◆ In the Delete Configuration dialog, selecting USB Drive tab shows the existing user configurations on the USB drive.
4. Select Delete.
5. Select OK.

20.7 Transferring a Configuration

When installing several monitors with identical user configurations, it is not necessary to set each unit separately. Use a USB drive to transfer the configuration from monitor to monitor.

20.7.1 Exporting a Configuration

To export the current monitor's configuration, follow this procedure:
1. Connect the N1 to the Dock.
2. Connect the USB drive to the Dock's USB port.
3. Select the Main Menu quick key → from the Configuration column select Manage → input the required password → Select.
4. Select **Export Configuration**.
5. Select the configurations and **User Maintenance Settings** to export.
6. Select **Export**.

### 20.7.2 Importing a Configuration

To import the configuration from the USB drive to the monitor, follow this procedure:

1. Connect the N1 to the Dock.
2. Connect the USB drive to the Dock’s USB port.
3. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → Select .
4. Select **Import Configuration**.
5. Select the configurations and **User Maintenance Settings** to import.
6. Select **Import**.

### 20.7.3 Loading a Configuration

You may make changes to some settings during operation. However, these changes or the pre-selected configuration may not be appropriate for the newly admitted patient. Therefore, the monitor allows you to load a desired configuration to ensure that all the settings are appropriate for your patient.

To load a configuration, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Load**.
2. Select the desired configuration.
   - Select the configuration on this monitor in the **Local** page.
   - Select the configuration on the USB drive in the **USB Drive** page.
3. Select **Load**.

**NOTE**

- The monitor may configure some settings by default when you load a configuration of different software version with the current configuration.

### 20.8 Printing Configurations

To print both factory configurations and user configurations, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select .
2. Select **Print Configuration**.
3. Select desired configurations.
4. Select **Print**.

### 20.9 Modifying Configuration Password

To modify the configuration password, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → Select .
2. Select **Modify Password**.
3. Respectively input the old password and new password.
4. Select **OK**.
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# 21 Password-protected User Settings

This chapter describes the password-protected functions accessed in the **Maintenance** dialog.

## 21.1 Setting the Device Location

### 21.1.1 Setting Monitor Information

To set monitor information, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Device Location** tab.
3. Input monitor name, facility name and department name.

### 21.1.2 Setting Monitor Location

If your monitor is installed at a fixed position, or you do not need clinicians to change the room number and bed number, you can set **Monitor Location** to **Fixed**. To set the monitor location, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Device Location** tab.
3. Set **Location**.
   - **Fixed**: the **Patient Management** dialog displays **Bed No.** and **Room No.**, but you cannot change them.
   - **Unfixed**: you can change **Bed No.** and **Room No.** from the **Patient Management** dialog.
4. Input the room number and bed number.

**NOTE**

- If **Location** is set to Unfixed, **Bed No.** and **Room No.** are cleared from the **Device Location** tab each time you discharge a patient.

## 21.2 Changing Patient Management Settings

### 21.2.1 Selecting Displayed Patient Information

You can define which items can be displayed and edited from the **Patient Management** tab. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Patient Management** tab.
3. Select the fields you want to display in the **Patient Management** dialog.
4. If necessary, select the customized fields and input names for these fields.

**NOTE**

- If the monitor is connected with the CMS, the patient information items and customized fields are loaded from the CMS.
21.2.2 Auto Discharging a Patient after Monitor Power Off

You can let the monitor automatically discharge after the monitor has been switched off for a period of time. To set the time period of discharging a patient, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Patient Management tab → select the Discharge tab.
3. Select a time for Auto Discharge When Power Off. The monitor will automatically discharge the patient when it is turned off for the designated period of time. The default is Never. That is to say the monitor will not automatically discharge a patient, regardless of how long the monitor has been switched off.

21.2.3 Selecting Query Criteria for Searching Patients in ADT Server

You can define which criteria can be used to search patients in the ADT server. To do so, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Patient Management tab → ADT Query tab.
3. Select the query criteria as desired.

21.2.4 Setting Patient Location Options for the Discharge Screen

To set options for patient location, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Patient Management tab.
3. Select the Location tab.
4. Input or edit patient location options.

21.2.5 Hiding Patient Name

To hide patient name on specific screens, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Patient Management tab.
3. Select the Display tab.
4. Set the following switches as desired:
   ◆ Switch off Primary Screen Display Full Name: does not display patient name in the patient information area on the primary display.
   ◆ Switch off Secondary Screen Display Full Name: does not display patient name in the patient information area on the secondary display, if configured.
   ◆ Switch off Remote View Display Full Name: does not display patient name in the patient information area on the remote monitors when this monitor is viewed by other monitors.
   ◆ Switch off Remote View Bedlist Display Full Name: does not display patient name in bed list on the remote monitors when this monitor is viewed by other monitors.

21.2.6 Select Whether a Prompt is Required When Auto Deleting Discharged Patients

The monitor automatically delete earlier discharged patients when the memory is limited. You can select whether an alarm is issued when discharged patients are automatically deleted and the monitor memory is very low.

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Set the Review tab → Discharged Patients tab.
3. Configure the alarms as needed:
21.3 Changing the Alarm Settings

21.3.1 Setting Alarm Tone Properties

21.3.1.1 Setting the Minimum Alarm Volume
To set the minimum alarm volume, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Alarm tab → Audio tab.

21.3.1.2 Setting the Audible Alarm Tone Pattern
You can distinguish the heart beat tone, pulse tone, and keystroke tone by frequency. You can choose any of the three tone patterns: ISO, Mode 1, and Mode 2. For more information, see 6.3.3 Alarm Indicators.
To set the alarm tone pattern, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Alarm tab → Audio tab.
3. Set Alarm Sound to ISO, Mode 1 or Mode 2.

21.3.1.3 Setting the Interval between Alarm Sounds
If you choose the ISO pattern, you can change the interval between alarm tones. To change the interval between alarm tones, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Alarm tab → Audio tab.

21.3.1.4 Setting Alarm Volume Escalation
The monitor provides the function of automatically escalating the alarm tone volume. When this function is enabled, if an alarm is not reset within the designated delay time after the alarm occurs, the volume of the alarm tone increases automatically.
To set the alarm volume escalation, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Alarm tab → Audio tab.
3. Set Auto Increase Volume.
   ◆ 2 Steps: if an alarm is not reset within the designated delay time after the alarm occurs, the alarm volume automatically increases by two levels.
   ◆ 1 Step: if an alarm is not reset within the designated delay time after the alarm occurs, the alarm volume automatically increases by one level.
   ◆ Off: if an alarm is not reset within the designated delay time after the alarm occurs, the volume of the alarm tone does not change.
4. Select Increase Volume Delay to set the delay time of alarm volume escalation.

**NOTE**

- The alarm volume escalation function is not applied to the latched alarms.

### 21.3.2 Setting Alarm Pausing and Resetting Properties

### 21.3.3 Defining the Pause Function

You can either pause alarms or pause alarm tones. This depends on the pause setting. To set the pause function, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select \[ \].
2. Select the **Alarm** tab → **Pause/Reset** tab.
3. Set **Pause** to **Alarm Pause** or **Audio Pause**. The default setting is **Audio Pause**.

#### 21.3.3.1 Setting the Alarm Pause Time/Alarm Tone Pause Time

The alarm pause time or alarm tone pause time can be set to 1 min, 2 min, 3 min, or Permanent. The default audio pause time is two minutes.

To set the alarm tone pause time, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select \[ \].
2. Select the **Alarm** tab → **Pause/Reset** tab.
3. Set **Pause Time**.

#### 21.3.3.2 Setting the Priority of Audio Paused Alarms

To select alarm of what priority can be paused or alarm sound of what priority can be paused, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select \[ \].
2. Select the **Alarm** tab → **Pause/Reset** tab.
3. Set **Pause Priority**.
   - **All**: pressing the **Alarm Pause** quick key pauses all alarms.
   - **Med & Low**: pressing the **Alarm Pause** quick key pauses alarms of medium and low priority. The high priority alarms will not be paused.
   - **Disable**: the **Alarm Pause** quick key is disabled.

#### 21.3.3.3 Disabling the Options of Prolonging Alarm Pause Time/Alarm Tone Pause Time

To disable specific options for the clinician when prolonging alarm pause time or the alarm tone pause time, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select \[ \].
2. Select the **Alarm** tab → **Pause/Reset** tab.
3. Switch off **Pause 5 min**, **Pause 10 min**, or **Pause 15 min**.
21.3.3.4 Setting Alarm Light Status on Alarm Reset
When the alarm system is reset, the monitor presents the alarm light by default, but you can switch off the alarm light. To change the alarm light setting, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select ![select](image).
2. Select the **Alarm** tab → **Pause/Reset** tab.
3. Set **Alarm Light**.
   - **On When Reset**: when the alarm system is reset, the alarm tones of the current alarms are switched off, but the alarm lamp remains flashing.
   - **Off When Reset**: when the alarm system is reset, both the alarm tone and alarm lamp of the current alarms are switched off.

21.3.3.5 Setting the Reminder Tones
When the alarm volume is set to zero, or the alarm is reset or switched off, the monitor issues a periodical reminder tone. The reminder tone is enabled by default.

To set the reminder tone, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select ![select](image).
2. Select the **Alarm** tab → **Pause/Reset** tab.
3. Set **Alarm Reset Reminder** and **Alarm Off Reminder**.
   - **On**: the monitor issues reminder tones at a designated interval.
   - **Re-alarm**: if the alarm condition persists the acknowledged alarms marked with “√” will be re-generated after the designated reminder tone interval.
   - **Off**: the monitor does not issue reminder tones at a designated interval. The acknowledged alarms marked with “√” will be silenced.
4. Set **Reminder Interval** to 10 min, 5 min, 3 min, 2 min, or 1 min.

21.3.4 Latching Physiological Alarms
To latch physiological alarms, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select ![select](image).
2. Select the **Alarm** tab → **Latching** tab.
3. Select how you want to latch the alarms. Alarm latching rules are as follows:
   - You can separately latch visible alarm signals and audible alarm signals.
   - Latching audible alarm signals simultaneously latches the corresponding visible signals.
   - Selecting alarms of lower priority simultaneously latches higher priority alarms.
   - Switching V-Tach Latching Lock off allows you to switch on or off V-Tach Latching.
   - When V-Tach Latching Lock is switched on, V-Tach latching follows the setting of Lethal alarm latching and you cannot control V-Tach Latching.

21.3.5 Changing Remote Alarm Settings

21.3.5.1 Resetting Alarms for Remote Devices
You can reset the alarms occurring on the remote devices that are viewed on the **Remote View** screen of the monitor. To enable this function, follow this procedure:
1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → **Remote View** tab.
3. Switch on **Reset Remote Bed Alarms**. Then the **Alarm Reset** button appears on the bottom left of the **Remote View** screen.

To reset any remote device alarms, the clinician may now select the **Alarm Reset** button at the bottom of the **Remote View** screen.

**NOTE**
* You can reset remote device alarms only if the Alarm Reset By Other Bed switch is on at the remote devices and alarms are occurring on the remote device.

### 21.3.5.2 Authorizing the Alarm Reset to Other Devices

Alarms on your monitor can be reset by remote devices if you enable this function. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → **Remote View** tab.
3. Switch on **Alarm Reset By Other Bed**.

### 21.3.5.3 Selecting the Alarm Reminder for Remote Devices

You can configure what alarm indicators are necessary for the remote devices. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → **Remote View** tab.
3. Select **Alarm Reminder**:
   - **Visible + Audible**: the monitor provides visual alarm indication, and continuous audible alarm indication if the alarm persists at the remote device.
   - **Visible + Single Tone**: the monitor provides visual alarm indication, and a single tone when the alarm occurs at the remote device.
   - **Visible Only**: the monitor only provides visual alarm indication.

### 21.3.5.4 Presenting Alarm Sound for Remote Devices as per Alarm Priority

You can configure what priority of remote device alarms are presented for audible notification. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → **Remote View** tab.
3. Select **Alarm Priority**:
   - **All**: the monitor sounds if an alarm occurs.
   - **High & Med**: the monitor sounds if a high or medium priority alarm occurs.
   - **High Only**: the monitor sounds only if a high priority alarm occurs.

### 21.3.5.5 Setting the Tone Pattern for Alarms from Remote Devices

The monitor provides the same alarm tone pattern for the remote device alarms as those for your monitor alarms. For more information on alarm tone pattern, see 6.3.3 Alarm Indicators.

To set the alarm tone pattern for the remote device alarms, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → select the **Remote View** tab.
3. Set **Alarm Sound** to **ISO, Mode 1** or **Mode 2**.

### 21.3.5.6 Switching Off the Remote Device Disconnection Alarm

The monitor can provide an alarm if remote devices, for example, a bedside monitor or a telemetry, are disconnected. By default, the function is enabled. To disable the alarm, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → **Remote View** tab.

Switch off **Remote Disconnected Alarm**.

### 21.3.6 Changing Alarm Priority Settings

#### 21.3.6.1 Setting the Priority of the ECG Lead Off Alarm

To set the priority of the ECG lead off alarm, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → select the **Other** tab.
3. Set the priority of **ECG Lead Off**.

#### 21.3.6.2 Setting the Priority of the SpO₂ Sensor Off Alarm

To set the priority of the SpO₂ sensor off alarm, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → select the **Other** tab.
3. Set the priority of **SpO₂ Sensor Off**.

#### 21.3.6.3 Setting the Priority of the IBP No Sensor Alarm

To set the priority of the IBP no sensor alarm, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → select the **Other** tab.
3. Set the priority of **IBP No Sensor**.

#### 21.3.6.4 Setting the Switch of the CMS and eGateway Disconnection Alarm

You can choose whether to issue an alarm when the monitor is not connected or disconnected from the CMS/ eGateway. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → **Other** tab.
3. In the **Other** block, switch on or off **CMS/eGW Disconnected Alarm**. If **CMS/eGW Disconnected Alarm** is switched off, the "Offline" alarm is not presented when the monitor is not connected or disconnected from the CMS/eGateway.

#### 21.3.6.5 Setting the Priority of the CMS and eGateway Disconnection Alarm

To set the priority of the CMS and eGateway disconnection alarm, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the Alarm tab → Other tab.
3. Set CMS/eGW Disconnected.

### 21.3.6.6 Setting the Switch of the SpO₂ Desat Alarm Off

You can choose whether switching off the SpO₂ Desat alarm is permissible or not. To do so, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Alarm tab → select the Other tab.
   - Disable: the SpO₂ Desat alarm is always on. The clinician cannot switch it off.
   - Enable: the clinician can switch off the SpO₂ Desat alarm. For more information, see 10.6.1 Changing the SpO₂ Alarm Settings.

---

**WARNING**

- If a clinician switches off the SpO2 Desat alarm, the monitor will not alarm when the patient’s SpO₂ is extremely low. This may result in a hazard to the patient.

---

### 21.3.6.7 Setting the Switch of the Zero RR Alarm Off

You can choose whether switching off the zero RR alarm is permissible or not. To do so, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Alarm tab → select the Other tab.
   - Disable: the zero RR alarm is always on. The clinician cannot switch it off.
   - Enable: the clinician can switch off the zero RR alarm. For more information, see 9.5.1 Setting the Resp Alarm Properties.

---

**WARNING**

- If a clinician switches off the zero respiration rate alarm, the monitor will not issue the zero respiration rate alarm when that situation occurs. This may result in a hazard to the patient. Keep the patient under close surveillance.

---

### 21.3.7 Changing Alarm Delay Settings

#### 21.3.7.1 Setting the Alarm Delay Time

For continuously measured parameters, you can set the alarm delay time. If the alarm condition is resolved within the delay time, the monitor does not present the alarm.

To set the alarm delay time, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Alarm tab → Other tab.

The setting of Alarm Delay is not applied to the zero respiration rate alarms and the ST alarms. You can set Zero RR Delay and ST Alarm Delay separately.
21.3.7.2 Setting the ST Alarm Delay Time
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select.
2. Select the Alarm tab → Other tab.

21.3.8 Adjusting the Alarm Light Brightness
To adjust the alarm light brightness, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select.
2. Select the Alarm tab → Other tab.
3. From the Alarm Light Brightness area, set Primary Screen (note that you may have to scroll up the dialog to see this option). If you set alarm light brightness to Auto, the monitor automatically adjusts the alarm light brightness according to the ambient light. The stronger the ambient light is, the brighter the alarm light is.

21.3.9 Changing Other Alarm Settings
21.3.9.1 Setting the Lethal Arrhythmia Alarms Switch
To allow a clinician to disable the lethal arrhythmia alarms, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select.
2. Select the Alarm tab → select the Other tab.
3. From the Other block, set Lethal Arrh Alarms Off as follows.
   ◆ Lethal Arrh Alarms Off is set to Disable by default. In this case, a clinician cannot switch off lethal arrhythmia alarms.
   ◆ If you set Lethal Arrh Alarms Off to enable, a clinician can switch off lethal arrhythmia alarms from the ECG dialog. For more information, see 7.6.4.1 Changing Arrhythmia Alarm Settings.

     WARNING

     • If any of lethal arrhythmia alarms are switched off, the ECG waveform area displays a message to indicate that corresponding alarms are off.
     • If a clinician switches off all arrhythmia alarms, the monitor will not present arrhythmia alarms. Always keep the patient under close surveillance.

21.3.9.2 Setting the Intubation Time
The default intubation time is 2 minutes. To change the intubation time, following this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select.
2. Select the Alarm tab → Other tab.
3. Set the Intubation Mode Period.

21.3.9.3 Setting Arrhythmia Alarm Timeout Period
The arrhythmia algorithm can disable alarm light and alarm tone for designated period of time when certain arrhythmia alarms are detected.
To set the arrhythmia alarm timeout period, follow this procedure:
1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Alarm** tab → select the **Other** tab.
3. From the **Other** block, set **Arrhy Shield Time**.

**NOTE**

- For the following alarms, alarm light and alarm tone cannot be disabled: HR high, HR low, Tachycardia, Bradycardia, Afib End, Irr. Rhythm End.
- The arrhythmia alarm timeout period is only applied to the medium priority chains and atrial fibrillation chain. For the alarms in the high priority chain, alarm tone and alarm light are presented as soon as the alarm condition is detected. Refer to 7.6.5.1 Arrhythmia Alarm Chains for more information on the arrhythmia alarm chain.
- Alarm indication rules for alarms in the atrial fibrillation chain are the same with those for the medium priority chains.

### 21.4 Changing CAA Settings (only available when the N1 is used with the independent external display)

#### 21.4.1 Changing EWS Settings

##### 21.4.1.1 Displaying and Managing the Operator ID

To display the operator ID on the EWS screen, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **CAA** tab → select the **EWS** tab.
3. Switch on **Operator ID**.
4. Select **Operator ID Timeout** to set how long the operator ID will remain valid.

##### 21.4.1.2 Managing the Scoring Tools

To manage the scoring tool, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **CAA** tab → select **EWS** tab.
3. Select the **Manage Score** button.
   - **Delete local scoring tools**: from the **Local** page, delete any unnecessary scoring tools.
   - **Import the desired scoring tools to the monitor**: from the USB drive page, select the scoring tools on the USB drive, and then select **Import**.

**NOTE**

- The monitor provides MEWS and NEWS by default. You cannot delete them.

#### 21.4.1.3 Selecting the Default Scoring Tool

To set the default scoring tool for different patient category, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **CAA** tab → select **EWS** tab.
3. From the **Select Default Score** area, set **Default Adult Score**, **Default Ped Score**, and **Default Neo Score**.
21.4.2 Setting GCS Threshold for Each Consciousness Level
You can configure the threshold and color of each consciousness level. To do so, follow this procedure:
1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select.
2. Select the **CAA** tab → select the **GCS** tab.
3. Set high limit, low limit for each level.

21.5 Changing Module Settings

21.5.1 Selecting the ECG Standard
Select the ECG standard according to the leadwires you are using. To select the ECG standard, follow this procedure:
1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select.
2. Select the **Module** tab → **ECG** tab.
3. Set **ECG Standard** to AHA or IEC.

21.5.2 Changing the QTc Formula
The monitor uses the Hodges correction formula by default to correct the QT interval for heart rate. To select the QTc formula, follow this procedure:
1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select.
2. Select the **Module** tab → **ECG** tab.
3. Set **QTc Formula**.
   ◆ Hodges: $QTc = QT + 1.75 \times (HeartRate - 60)$
   ◆ Bazett: $QTc = QT \times \left(\frac{HeartRate}{60}\right)^{\frac{1}{2}}$
   ◆ Fridericia: $QTc = QT \times \left(\frac{HeartRate}{60}\right)^{\frac{2}{3}}$
   ◆ Framingham: $QTc = QT + 154 \times \left(1 - \frac{60}{HeartRate}\right)$

21.5.3 Setting the 12-Lead Order Switch
To set whether to send the order number of 12-lead interpretation report to the hospital information system while saving the report, follow this procedure:
1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select.
2. Select the **Module** tab.
3. Select the **ECG** tab.
4. Set **12-Lead Order**.

21.5.4 Calibrating ECG
The ECG signal may be inaccurate due to hardware or software problems. As a result, the ECG waveform amplitude becomes greater or smaller. In that case, you need to calibrate the ECG module. To do so, follow this procedure:
1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select.
2. Select the **Module** tab → **ECG** tab.
3. From the bottom left corner of the dialog select **Calibrate**.

### 21.5.5 Setting Parameter Measurement Timeout

NIBP measurements become outline fonts after a preset time. This feature prevents older values being misinterpreted as current measurements. To adjust the timeout period for PAWP, and NIBP, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Module** tab → select **Other**.
3. Set the timeout period for PAWP and NIBP.

### 21.5.6 Setting Flow Rate (For Sidestream CO2 Module Without O2)

When you are using the sidestream CO2 module without the O2 monitoring function to monitor a neonatal patient, you can select flow rate. To do so, follow this procedure:

1. Ensure that the sidestream module without O2 is inserted in the monitor.
2. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
3. Select the **Module** tab → **Other** tab.
4. Set **CO2 Flow Rate For Neo**.

### 21.6 Setting the Printer

#### 21.6.1 Setting the Printer

To set a network printer, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Print** tab.
3. In the **Printer** tab, select **Connection Type** to choose whether you want to output patient reports via the print server or a network printer.
4. If you set **Connection Type** to **Print Server**, perform the following settings:
   - **Print Server Address**: select to input the printer server name or IP address.
   - **Port**: select to input the printer server port. If the CMS is used as the printer server, set **Port** to 6603.
   - Set the report type in the **Report Type** area. For more information, see section 21.6.2 **Setting the Report Type**.
5. If you set **Connection Type** to **Printer**, perform the following settings:
   - Select **Printer IP Address**. Select to input the IP address of the desired network printer.
   - Select **Paper Size**.
   - Select **Resolution**.

After finishing configurations, you can select the **Print Test Page** button to verify that the printer works properly.

#### 21.6.2 Setting the Report Type

If the **Connection Type** is set to **Print Server**, you need to set the report type:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Print** tab.
3. Set Connection Type to Print Server.
4. Select the report you intend to set, for example, General Report.
5. Set the Print Action:
   - Paper: outputs paper report.
   - PDF: outputs the electronic report in PDF format.
   - Paper And PDF: outputs both the paper report and the PDF report.
6. For paper report, respectively select Printer and Printer Resolution to set the default printer and the resolution for the default printer.
7. For PDF report, select the PDF Resolution to set the resolution.

**NOTE**
• General reports refer to the reports other than the end case report and realtime alarm report.

### 21.6.3 Setting Patient Information on General (Non-12-lead) Reports
To set the patient information you want to display on general reports, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Print tab.
4. Select the desired items under Report Name. N/A indicates that this item is not displayed on a report.

### 21.6.4 Setting Patient Information on 12-lead ECG Reports
To set the patient information you want to display on 12-lead ECG reports, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Print tab.
3. select the ECG Report tab.
4. On the right of the ECG Report page, select the desired patient information items. Patient ID, Patient Name, Age, and Gender are displayed on an ECG report by default.

**NOTE**
• You can only set the patient information to display on the ECG report from the ECG Report page. Patient information configured in the Report Layout page is not applied to ECG reports.

### 21.6.5 Configuring the Name of PDF Files
If you use the printer server to output patient reports, you can use the PDF printer to output PDF format reports. To configure the name of PDF files, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Print tab → PDF File Name tab.
3. Select the desired items and their sequence under PDF File Name. N/A refers to no information.

### 21.6.6 Showing the Second Mark
To set whether you want to show second marks on the report output by the printer, follow this procedure.

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Print tab → Other tab.
3. Enable or disable Second Mark (Printer).
21.6.7 Setting Parameter Unit

To set parameter unit, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select **J**.
2. Set the **Unit** tab.
3. Set unit for each parameter.

21.7 Enabling Auto Daylight Savings Time

By default, daylight savings time is disabled. You need to manually enable the daylight savings time. To auto start the daylight savings time, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select **J**.
2. Select the **Time** tab.
3. Switch on **Auto Daylight Savings Time**.
4. Adjust daylight savings time settings as necessary.

**NOTE**

- If you enable Auto Daylight Savings Time you cannot manually switch it on or off from the System Time dialog. For more information, see 3.8.1 Setting the Date and Time.

21.8 Viewing Version Information

To view the system software version, module hardware and software version, and firmware version, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select **J**.
2. Select the **Version** tab.

You can also view the system software version by selecting the **Main Menu** quick key → from the **System** column select **Version**.

21.9 Checking Battery Information

The monitor provides the following battery information:

- Remaining battery capacity
- Battery voltage
- Battery chip temperature

To check the battery information, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select **J**.
2. Select the **Battery Information** tab.

21.10 Changing Scanner Settings

For the 2D barcode reader, you can change the scanner settings.

21.10.1 Establish the Relationship between Patient Demographics and 2D Barcode Fields (for the Mindray Custom 2D Barcode Reader)

To configure 2D barcode reader, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select **J**.
2. Select the **Scanner** tab → **2D Barcode** tab.
3. Establish the relationship between the monitor data and hospital's barcode data for selectable patient demographics. For example, the monitor has an option of **Ped** for patient category. In your hospital barcode, the text may read as **Pediatric**. So input **Pediatric** for the field **Ped** to establish their relationship.

### 21.10.2 Setting the Barcode Reader Information

To set the barcode reader information, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select 
2. Select the **Scanner** tab → **Scanner Info.** tab.
3. Set **Scanner Type**:
   - **1D Scanner**: select this option when using a 1D scanner or a 2D scanner other than the Mindray custom 2D scanner.
   - **2D Scanner**: select this option when using the Mindray custom scanner.

**NOTE**

- When you set **Scanner Type** to 2D Scanner, default settings are applied to Data Encoding Type and Data Parse Mode. You do not need to change these settings.

### 21.10.3 Identifying the Barcode Reader (for the non-Mindray Custom 2D Barcode Reader)

When you are using barcode readers other than the JADAK Flexpoint HS-1R or HS-1M, you should select the barcode reader from the USB device list, so that the monitor can identify the barcode reader. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select 
2. Select the **Scanner** tab → **Identifying Scanner** tab.
3. From the USB device list, select the barcode reader you are using.

### 21.10.4 Selecting Patient Information Read by the Barcode Reader (for the Mindray Custom 2D Barcode Reader)

To select desired patient information that will be read by the barcode reader, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select 
2. Select the **Scanner** tab → **Field** tab.
3. Select the patient information encoded in the bar code. The selected information can be read by the barcode reader.

**NOTE**

- The patient information read by the barcode reader is dependent on the patient information encoded in the hospital's barcodes.

### 21.11 Configuring the Network

You can connect the monitor to the central monitoring system (CMS), eGateway, and other monitors through wired LAN or wireless LAN.
21.11.1 Network Safety Information

**CAUTION**

- Wireless network designing, deploying, debugging, and maintenance should be executed by Mindray service personnel or authorized technicians.
- Always set the wireless network according to local wireless regulations.
- Keep network authentication information, for example passwords, safe, to protect the network from being accessed by unauthorized users.
- Do not connect non-medical devices to the monitor network.
- If wireless network signal is poor, there may be a risk of CMS-destined data loss.
- RF interference may result in wireless network disconnection.
- Disconnecting from the network may result in CMS-destined data loss and function failure. Check the patient in case of network disconnection and solve the network problem as soon as possible.
- Ensure that the monitor IP address setting is correct. Changing the network settings may result in network disconnection. Contact your service personnel if there are any problems with the IP address.

21.11.2 Setting the Wireless Network

To set the wireless network, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select 
2. Select the **Network Setup** tab → **WLAN**.
3. Input **SSID**, **Security**, and **Password**.
4. Select the **WLAN IP** tab and select how to get the IP address.
   - **Obtain IP Address Automatically**: the monitor automatically gets the IP address.
   - **Use the Following Address**: you need to input the IP address, Subnet Mask, and Gateway.
5. Select how to get the DNS address:
   - **Obtain DNS Address Automatically**: the monitor automatically gets the DNS address.
   - **Use the following DNS Address**: you need to input the IP address of Preferred DNS server and Alternate DNS server.

The monitor supports the following security methods: WPA2 PSK, WPA2 AES, CCKM AES, WPA PSK AES, WPA AES. Select the security method as desired. You may need to set more parameters for some security methods.

After configuring the wireless network, select **WLAN** → **Network Test** to verify that the wireless network can be properly connected.

21.11.3 Selecting WLAN Band and Channels

The monitor supports 2.4 GHz and 5 GHz WLAN. To select WLAN band rate and channels, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select 
2. Select the **Network Setup** tab → **WLAN** tab.
3. Select the **WLAN Setup** button from the bottom left corner of the dialog.
4. Set **WLAN Band** to **Auto**, 5G, or 2.4G according to the band you are using. The default is **Auto**, which means the monitor can automatically identify the WLAN band.
5. Select **Auth Server Type** to set the type of authentication server.
6. Set **BGN Channel**.
7. Set **AN Channel**.
21.11.4 Managing Certifications

You can delete certifications from the monitor, or import certifications from the USB memory device. To do so, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Network Setup tab → WLAN tab.
3. Select the Certificate Management button from the bottom left corner of the dialog.
   - From the Local tab, select certifications you want to delete from the monitor, and then select Delete.
   - From the USB Drive tab, select certifications you want to import from the USB memory device, and then select Import.

21.11.5 Setting Multicast Parameters

Multicast helps device discovery between monitors and other devices on the network. Devices in the same multicast group can be mutually discovered.

To set multicast parameters, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Network Setup tab → Device Discover tab.
3. Set Multicast TTL.
4. Set Multicast Address.

21.11.6 Setting the Network Service Quality Level

To set the quality of service (QoS), follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Network Setup tab → QoS tab.
3. Select QoS Level For Realtime Monitoring to set the service quality of network connection for realtime monitoring, for example parameter measurements and waveforms, alarms, etc.
4. Select QoS Level For Others to set the service quality of network connection for non-realtime monitoring, for example history data, printing, etc.

21.11.7 Using the ADT Gateway

The ADT (admit-discharge-transfer) gateway is normally deployed in the eGateway. You can obtain patient information from the hospital ADT server through the ADT gateway.

To configure the ADT gateway, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Network Setup tab → ADT tab.
3. Select Server Address to input the host name or IP address of the ADT gateway.
4. Select Port to input the port of the ADT gateway.
   - ADT Query is switched off by default. You can load patient information to the monitor from the ADT server only when this function is enabled.

After configuring the ADT gateway, select Network Test to verify that the ADT server is properly connected.

21.11.8 Sending Realtime Data, Waveforms and Alarms via HL7 Protocol

You can send the realtime data, waveforms, and alarms from the monitor to the hospital servers via HL7 protocol. To do so, follow this procedure:
1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select  

2. Select the **Network Setup** tab → **HL7 Configuration** tab.

3. From the **Data + Waveforms** area, select **Server Address** to input the name or IP address for the server receiving the realtime data and waveform. Set **Port**.

4. Switch on **Send Data** and **Send Waveform**, as needed. Set **Data Interval**.

5. From the **Alarms** area, select **Server Address** to input the name or IP address for the server receiving the alarm data. Set **Port**.

6. Switch on **Send Alarms** as needed.

This page also displays the server connection status.

### 21.11.9 Selecting Data Encryption Type

To set data encryption type, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select  

2. Select the **Network Setup** tab → **Information Security** tab.

3. Select **Encryption Connection Type** to set data encryption type when connecting devices:
   - **Only Private Encryption**: Mindray private encryption is used to encrypt the transmitted data. You cannot connect devices supporting SSL (secure sockets layer) encryption.
   - **SSL Encryption Priority**: for devices supporting SSL encryption, SSL encryption is used when connecting the devices. For devices not supporting SSL encryption, private encryption is used when connecting the devices.

### 21.11.10 Disabling the Broadcasting Patient Demographics Function

When viewing other patients, device location and patient information of remote devices are displayed in the remote device list by default. To protect patient privacy, you can disable the broadcasting of patient demographics function to prevent the monitor from sending patient information via broadcast. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select  

2. Select **Network Setup** tab → **Information Security** tab.

3. Switch off **Broadcast Patient Demographics**.

Thus, patient information will not display in the remote device list.

### 21.12 MLDAP

MLDAP refers to Mindray LDAP (Lightweight Directory Access Protocol). It is an independent process which can be installed on the eGateway or other application server (Windows). MLDAP provides user identity and authentication.

The MLDAP server is connected with the hospital LDAP server. All monitoring devices are connected to the MLDAP server to implement identity and authentication for the following operations:

- Changing alarm settings
- Changing arrhythmia settings
- Accessing the **Maintenance** dialog

#### 21.12.1 Setting MLDAP

To access the MLDAP server, you should set your monitor as follows:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select  

2. Select the **Network Setup** tab → **MLDAP** tab.
3. Set Server address and port of the MLDAP server.

### 21.12.2 Testing MLDAP Server Connection

To test whether the monitor is properly connected with the MLDAP server, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select 🔔
2. Select the **Network Setup** tab → **MLDAP** tab.
3. Select **Network Test**.

### 21.12.3 Selecting Password for User Authentication

You can select what password is used when changing alarm settings, arrhythmia settings, and accessing the **Maintenance** dialog. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select 🔔
2. Select the **Authorization Setup** tab.
3. From the **Maintenance** area, set **User Maintenance** to select the password for accessing the monitor’s **Maintenance** dialog.
   - **Local Password**: the monitor’s password for accessing the **Maintenance** dialog is required.
   - **User Password**: the user name and password saved in the MLDAP server are required.
4. From the **Others** area, set **Alarm Setup**: select the password for changing alarm settings.
   - **No Password**: changing alarm settings is not password protected.
   - **Local Password**: changing alarm switch, alarm limit, and alarm priority is password protected. The monitor’s password for changing alarm settings is required.
   - **User Password**: changing alarm switch, alarm limit, and alarm priority is password protected. The user name and password saved in the MLDAP server are required.
5. Set **Arrhythmia**: select the password for changing arrhythmia settings.
   - **No Password**: changing arrhythmia settings is not password protected.
   - **Local Password**: changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The monitor’s password for changing arrhythmia settings is required.
   - **User Password**: changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The user name and password saved in the MLDAP server are required.

From the **Maintenance** area, selecting **Modify Local Password** can change the monitor’s password for accessing the **Maintenance** dialog.

From the **Others** area, selecting **Modify Local Password** can change the monitor’s password for accessing alarm settings and arrhythmia settings.

### 21.12.4 Setting the Password Timeout Period

If you use the password saved in the MLDAP server to access the **Maintenance** dialog, alarm settings and/or arrhythmia settings, you can set the password timeout period. Once the timeout period is reached, you will need to re-enter the password. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select 🔔
2. Select the **Authorization Setup** tab.
3. Set **Retention Time**.

### 21.13 Connecting the Monitor to the CMS

To connect the monitor to the CMS, follow this procedure:

1. Set the **IP address**, **Subnet Mask**, and **Gateway**. For more information, see section 21.11 Configuring the Network.
2. Connect the monitor to the CMS through either of the following methods:
   ◆ Admit the monitor on the CMS. Refer to the BeneVision Central Monitoring System Operator’s Manual (PN: 046-007687-00) for details of admitting a monitor.
   ◆ Setting the CMS (refer to section 21.13.1 Setting the CMS for details), and then selecting a CMS (refer to section 21.13.2 Selecting a CMS for details).

21.13.1 Setting the CMS
You can add up to 30 central stations (CMS) for your monitor. To set the CMS, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Network Setup tab → Central Station Setup tab.
3. Select Add Central Station and set the Name, Department, and Server Address of the CMS.
4. Edit or delete the CMS as desired.

21.13.2 Selecting a CMS
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Network Setup tab → Central Station Setup tab.
3. Enable the Select CMS.
4. Select the system status information area at the top right corner of the screen.

21.14 Connecting the eGateway
You can connect the monitor to the eGateway to implement interaction between the monitor and external devices. When connected to the eGateway, the system provides the following functions:
- The monitor can transmit parameter values, waveforms, alarm settings, and events to the eGateway.
- Clock can be synchronized between the monitor and the eGateway.

21.15 Setting the Dock
After the N1 is transferred to the target location, connecting the N1 to a Dock enables N1 to use the settings of the Dock. All the settings in this section are stored in the Dock. When the N1 is disconnected from the Dock, the N1 uses its own settings and network.

21.15.1 Setting the Work Mode
To set the work mode of the Dock, follow this procedure:
1. Connect the N1 to the Dock.
2. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
3. Select the Dock Setup tab → select the Setup tab.
4. Set the Work Mode. The default work mode is Dock Mode.
   ◆ Dock Mode: the patient location settings (facility, department, room number, and bed number), printer settings, and authorization settings are from the N1. You can change these settings on Device Location, Print, or Authorization Setup page from the Maintenance menu.
   ◆ Host Mode: the patient location settings (facility, department, room number, and bed number), printer settings, and authorization settings are from the Dock. You can change these settings on Location, Printer, or Authorization Setup tab from the Dock Setup page.

21.15.2 Setting the Net Setting Type
To set the network setting type of the Dock, follow this procedure:
1. Connect the N1 to the Dock.

2. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .

3. Select the Dock Setup tab → select the Setup tab.

4. Set the Net Setting Type. The default work mode is Use current N1 net setting.
   ◆ Use current N1 net setting: the IP and WLAN settings are from the N1. You can change these settings on Network Setup page from the Maintenance menu.
   ◆ Use current Dock net setting: the IP and WLAN settings are from the Dock. You can change these settings on IP, or WLAN tab from the Dock Setup page.

21.15.3 Setting the Network of the Dock

21.15.3.1 Selecting a Network Type
To select network type, follow this procedure:

1. Connect the N1 to the Dock.

2. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .

3. Select the Dock Setup tab → select the Setup tab.

4. Set the Work Mode to Host Mode.

5. Select the IP tab.

6. Set Network Type to LAN1 IP, or WLAN according to your network type.

21.15.3.2 Setting the Wired Network
Wired networking is available as long as N1 is connected to the Dock. To set the wired network, follow this procedure:

1. Connect the N1 to the Dock.

2. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .

3. Select the Dock Setup tab → select the Setup tab.

4. Set the Work Mode to Host Mode.

5. Select the IP tab.

6. Set Network Type to LAN1 IP.

7. Select how to get the IP address of wired network.
   ◆ Obtain IP Address Automatically: the monitor automatically gets the IP address.
   ◆ Use the Following Address: you need to input the IP address, Subnet mask, and Gateway.

8. Select how to get the DNS address:
   ◆ Obtain DNS Address Automatically: the monitor automatically gets the DNS address.
   ◆ Use the following DNS Address: you need to input the IP address of Preferred DNS server and Alternate DNS server.

21.15.3.3 Setting the Wireless Network
To set the wireless network of the Dock, follow this procedure:

1. Connect the N1 to the Dock.

2. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .

3. Select the Dock Setup tab → select the Setup tab.

4. Set the Work Mode to Host Mode.

5. Select the IP tab, and set Network Type to WLAN.
6. Select how to get the IP address of wireless network.
   ◆ Obtain IP Address Automatically: the monitor automatically gets the IP address.
   ◆ Use the Following Address: you need to input the IP address, Subnet Mask, and Gateway.

7. Select how to get the DNS address:
   ◆ Obtain DNS Address Automatically: the monitor automatically gets the DNS address.
   ◆ Use the following DNS Address: you need to input the IP address of Preferred DNS server and Alternate DNS server.

8. Select the WLAN tab and set SSID, Security, and Password.

After configuring the wireless network, select Network Test to verify that the wireless network can be properly connected.

### 21.15.4 Setting the External Display

To set the external display, follow this procedure:

1. Connect the N1 to the Dock.
2. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
3. Select the Dock Setup tab → select the Setup tab.
4. Set the External Screen Contents.
   ◆ Mirrored: the contents of the external display is exactly the same with the monitor.
   ◆ Independent: separately configure the contents and layout of the monitor and external display.

**NOTE**

- The N1’s screen and the independent external display’s screen cannot be viewed simultaneously. To switch the viewing location between the N1’s screen and the independent external display, gently press the power switch of the N1, or double click on the screen to be viewed.
- In the situation that the External Screen Content is set to Independent and the viewing location is switched to the N1, if there is no operation on the monitor within one minute, the viewing location will automatically switch back to the external display.

### 21.16 Defining Other Functions

#### 21.16.1 Setting Notch Filter Frequency

Set notch filter frequency according to the power line frequency of your country. To set notch filter frequency, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select ．
2. Select the Other tab.
3. Set Notch Frequency to 50 Hz or 60 Hz according to the power line frequency.

#### 21.16.2 Setting Mouse Sensitivity

The mouse sensitivity is adjustable. To do so, follow this procedure:

1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select ．
2. Select the Other tab.
21.16.3 Setting the SpO₂ Tone Mode

The monitor adjusts the QRS tone (pitch tone) according to the SpO₂ values. To set the SpO₂ tone mode, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Other** tab.
3. Set **SpO2 Tone** to **Mode 1** or **Mode 2**. The pitch changes more rapidly in Mode 2 than in Mode 1, as saturation levels change.

The SpO₂ tone mode chart for SpO₂ between 40% to 100% is as follows:

![SpO2 Tone Chart](image)

**CAUTION**

- It is highly recommended to use the same SpO₂ tone mode for the same monitors in a single area to prevent issues arising from inconsistent operation.

21.16.4 Selecting the Language

To set the user interface (UI) language, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Other** tab.
3. Set **Language**.

21.16.5 Switching On or Off a Parameter

If there is no **Parameters On/Off** tab in the **Screen Setup** dialog then setting parameter switches is password protected. Follow this procedure to set parameter switches:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Other** tab.
3. Select **Parameters On/Off**.
4. Enable or disable desired parameters.

When a parameter is switched off, the monitor stops data acquisition and alarming for this measurement.
NOTE

• When a parameter is manually switched off and the corresponding parameter module is plugged in, you cannot monitor this parameter.

21.16.6 Setting If Setting Parameter Switches is Protected

You can set whether setting parameter switches is password protected. To do so, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Other tab.
3. Switch on or off Parameters On/Off Protected.

21.16.7 Setting If Parameter Switch is Influenced by Configuration

You can set if the settings of parameter switches are influenced by loading a configuration. To do so, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Other tab.
3. Switch on or off Parameters On/Off Config Influenced.

21.16.8 Hiding Undesired Review Tabs

If you do not need to review some items, you can hide them. To do so, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Set the Review tab.
3. From the Tabs page, Event page, or Arrh Mark page, deselect those you do not need to be available to clinicians during review.

21.16.8.1 Setting the Outdoor Mode

To set the way of entering the outdoor mode, follow this procedure:
1. Select the Main Menu quick key → from the System column select Maintenance → input the required password → select .
2. Select the Other tab.
3. Set Enter Outdoor Mode to Manual or Auto.
   ◆ Manual: The monitor enters the outdoor mode by manually selecting the Main Menu quick key → from the Display column select Enter Outdoor Mode.
   ◆ Auto: The monitor enters the outdoor mode automatically if the strength of ambient light is greater than the threshold.
22 Battery

22.1 Battery Introduction
This monitor is designed to run on rechargeable Lithium-ion battery power when the external power is not available. The monitor can switch between battery power and the external power without interrupting patient monitoring. If both the external power and the battery power are available, the monitor uses the external power in preference to the battery power.

22.2 Battery Safety Information

WARNING

• Keep the battery out of children’s reach.
• Use only specified battery. Use of a different battery may present a risk of fire or explosion.
• Keep the battery in their original package until you are ready to use them.
• Do not expose the battery to liquid.
• Do not crush, drop or puncture the battery. Mechanical abuse can lead to internal damage and internal short circuits. If a battery has been dropped or banged against a hard surface, whether damage is externally visible or not, remove the battery from use and dispose of it properly.
• If the battery shows signs of damage or signs of leakage, replace it immediately. Use caution in removing the battery. Avoid contacting the leakage.
• The battery should be charged only in this monitor.
• Extremely high ambient temperature may cause battery overheat protection, resulting in monitor shutdown.
• The lithium-ion battery has a service life. Replace your battery when it reaches the end of its service life. Failure to replace the battery may cause serious damage to your equipment from battery overheating.
• Do not open the battery, heat the battery above 60 °C, incinerate battery, or short battery terminals. They may ignite, explode, leak or heat up, causing personal injury.

CAUTION

• Remove the battery if it will not be used for an extended period of time.

22.3 Installing the Battery
The battery must only be installed by service personnel trained and authorized by Mindray. To install the battery, contact your service personnel. The battery is installed when the monitor leaves the factory.

22.4 Battery Indications
The battery LED, on-screen battery symbol, battery power indicator, and related alarm messages indicate the battery status.

22.4.1 Battery LED
The battery LED lies on the lower right corner of the monitor front panel.
The battery LED indications are as follows:
- Yellow: the battery is being charged.
- Green: the battery is fully charged.
- Flashing green: the monitor runs on battery power.
- Flashing yellow: the battery is malfunctioning.
- Off: no battery is installed, or the monitor is powered off and no external power is connected.

### 22.4.2 Battery Symbols

The on-screen power indicator indicates the battery status as follows:
-  
  indicates that the battery is working correctly. The green portion represents the remaining charge.
-  
  indicates that the battery power is low and needs to be charged.
-  
  indicates that the battery is almost depleted and needs to be charged immediately. Otherwise, the monitor will automatically shut down soon.
-  
  indicates that the battery is being charged.
-  
  indicates that no battery is installed.
-  
  indicates a battery fault, battery communication fault, or battery charging fault. Contact service personnel for help.

### 22.4.3 Battery Power Indicator

Battery power indicator displays the remaining battery power.

### 22.4.4 Battery-related Alarms

The capacity of the battery is limited. When the battery is low, the monitor presents the **Low Battery** alarm, the alarm lamp flashes, and the monitor produces an alarm sound.

If the battery is almost depleted, the monitor presents the **Critically Low Battery** alarm. In this case, immediately connect external power to the monitor and charge the battery. Otherwise, the monitor will automatically shut down soon.

If the battery has been used for a prolonged period of time, the battery will be aged and its runtime may be significantly less than the specification. If the battery is aged, the **Battery Service Required** alarm is presented each time the monitor is turned on, indicating that the battery has reached its end of life.

For more information on battery-related alarms, see *D Alarm Messages*.
22.4.5 Checking the Battery Information

To check the battery information, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select .
2. Select the **Battery Information** tab.

22.5 Charging the Battery

To optimize performance, a fully (or nearly fully) discharged battery should be charged as soon as possible. The battery can be charged in any of the following methods:

- Method 1: the monitor is connected to the AC adapter or Dock.
- Method 2: the monitor is in use with a host monitor.
- Method 3: the monitor is in use with the Transport Dock.

For method 1 and method 3, the battery is charged regardless of whether or not the monitor is currently turned on. For method 2, the host monitor must be powered on for the N1 monitor's battery to charge.

22.6 Maintaining the Battery

22.6.1 Conditioning the Battery

The performance of the battery deteriorates over time. You should condition the battery every three months.

To condition a battery, follow this procedure:

1. Disconnect the monitor from the patient and stop all monitoring and measuring procedures.
2. Turn off the monitor, and connect the monitor to the external power source.
3. Allow the battery to be charged uninterruptedly until it is fully charged.
4. Disconnect the monitor from the external power source, and turn on the monitor.
5. Allow the monitor to run on the battery until the battery is completely depleted and the monitor automatically shuts down.
6. Fully charge the battery again for use or charge it to 40 – 60% for storage.

**NOTE**

- If the battery is not conditioned for a prolonged time, its charge indication may not be accurate and you may wrongly evaluate the remaining battery runtime.
- Do not use the monitor to monitor a patient during battery conditioning.
- Do not interrupt battery conditioning.

22.6.2 Checking Battery Performance

Life expectancy of a battery depends on how frequent and how long it is used. When properly used, the lithium-ion battery has a useful life of approximately two years. If improperly used, its life expectancy can be shorter. We recommend replacing the lithium-ion battery every two years.

The performance of a rechargeable battery deteriorates over time. You should check the battery performance every two months or if you question it is meeting the product specifications.

See steps 1 to 5 of 22.6.1 *Conditioning the Battery* to check battery performance. The operating time of the battery reflects their performance directly. If the operating time of a battery is noticeably shorter than that stated in the specifications, the battery may have reached its service life or be malfunctioning. If the battery performance meets the requirement, fully charge the battery again for use or charge it to 40 – 60% for storage.

**NOTE**

- Battery operating time depends on equipment configuration and operation. For example, high display brightness or measuring NIBP repeatedly will shorten the battery operating time.
22.7 Storing the Battery

When storing the battery, make sure that the battery terminals do not come into contact with metallic objects. If the battery are stored for an extended period of time, place the battery in a cool place with a partial charge of 40% to 60% capacity.

Condition the stored battery every three months. For more information, see 22.6.1 Conditioning the Battery.

NOTE

• Remove the battery from the equipment if the equipment is not used for a prolonged time (for example, several weeks). Otherwise the battery may overdischarge.
• Storing the battery at high temperature for an extended period of time will significantly shorten their life expectancy.
• Storing the battery in a cool place can slow the aging process. Ideally the battery should be stored at 15 °C.

22.8 Recycling the Battery

Discard a battery in the following situations:

■ The battery has visual signs of damage.
■ The battery fails.
■ The battery is aged and its runtime significantly less than the specification.
■ The battery has been used for more than its service time.

Properly dispose of the battery according to local regulations.

WARNING

• Do not open the battery, heat the battery above 60 °C, incinerate the battery, or short the battery terminals. They may ignite, explode, leak or heat up, causing personal injury.
23 Care and Cleaning

23.1 Care and Cleaning Introduction

In this chapter we only describe cleaning and disinfection of the main unit, parameter modules, Modular Rack, Dock, folding hook, monitor handle, bedrail hook, and certain accessories. For the cleaning and disinfection of the Transport Dock and other reusable accessories, refer to their instructions for use.

Keep your equipment and accessories clean. To avoid damage to the equipment, follow these guidelines:

■ Always follow the manufacturer’s instructions for each cleaning / disinfecting agent.
■ Do not immerse any part of the equipment or accessories into liquid.
■ Do not pour liquid onto the equipment or accessories.
■ Do not allow liquid to enter the case.
■ Never use abrasive materials (such as steel wool or silver polish), or erosive cleaners (such as acetone or acetone-based cleaners).

23.2 Care and Cleaning Safety Information

WARNING

• Be sure to turn off the system and disconnect all power cables from the outlets before cleaning the equipment.

CAUTION

• If you spill liquid on the equipment or accessories, contact Mindray or your service personnel.
• Avoid wetting the pins and metal parts of the equipments, mounting kits, or accessories during cleaning and disinfection.
• Use only Mindray approved cleaners and disinfectants and methods listed in this chapter to clean or disinfect your equipment. Warranty does not cover damage caused by unapproved substances or methods.
• We make no claims regarding the efficacy of the listed chemicals or methods as a means for controlling infection. For the method to control infection, consult your hospital’s Infection Control Officer or Epidemiologist.
• The responsible hospital or institution shall carry out all cleaning and disinfection procedures specified in this chapter.
• Refer to the respective instructions for use of the cleaning agents and disinfectants.
• Do not mix disinfecting solutions (such as bleach and ammonia) as hazardous gases may result.

NOTE

• To clean or disinfect reusable accessories, refer to the instructions delivered with the accessories.
23.3 Cleaning and Disinfecting the Equipment and Mounting Kits

Use approved cleaning and disinfecting agents for cleaning or disinfecting the main unit, parameter modules, Modular Rack, Dock, folding hook, monitor handle, and bedrail hook.

23.3.1 Approved Cleaning and Disinfecting Agents

The following table lists approved cleaning and disinfecting agents:

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Product Type</th>
<th>Active Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hypochlorite bleach</td>
<td>Liquid</td>
<td>Sodium hypochlorite bleach 0.5%</td>
</tr>
<tr>
<td>Hydrogen peroxide</td>
<td></td>
<td>Hydrogen peroxide 3%</td>
</tr>
<tr>
<td>Isopropanol</td>
<td></td>
<td>Isopropanol 70%</td>
</tr>
<tr>
<td>1-Propanol</td>
<td></td>
<td>1-Propanol 50%</td>
</tr>
<tr>
<td>Metrex CaviCide1™</td>
<td></td>
<td>Diisobutylphenoxyethoxyethyl dimethyl benzyl ammonium chloride 0.28%, Isopropanol 17.2%</td>
</tr>
<tr>
<td>Virex® II 256 (1:256)</td>
<td></td>
<td>Didecyl dimethyl ammonium chloride 8.704%, n-Alkydimethyl benzyl ammonium chloride 8.190%</td>
</tr>
<tr>
<td>Virex® TB</td>
<td></td>
<td>n-Alkyl dimethyl benzyl ammonium chlorides 0.105%, n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.105%</td>
</tr>
<tr>
<td>Rely+On™ Virkon® High Level Surface Disinfectant</td>
<td>Powder</td>
<td>Used as 1% solution Biocidal active: Pentapotassium bis (peroxymonosulphate) bis (sulphate)(500g/kg). Contains dipotassium peroxodisulphate.</td>
</tr>
</tbody>
</table>
23.3.2 Cleaning the Equipment and Mounting Kits

The main unit, parameter modules, Modular Rack, Dock, folding hook, monitor handle, and bedrail hook should be cleaned on a regular basis. Before cleaning the equipment or mounting kits, consult your hospital’s regulations for cleaning the equipment.

To clean your equipment, follow this procedure:

1. Shut down the monitor and disconnect it from the AC power.
2. Clean the display screen with wipes or a soft cloth moistened with one of the cleaning agents listed in 23.3.1 Approved Cleaning and Disinfecting Agents only.
3. Clean the exterior surface of the equipments, or mounting kits with wipes or a soft cloth moistened with one of the cleaning agents listed in 23.3.1 Approved Cleaning and Disinfecting Agents only.
4. Wipe off all the cleaning agent residue with a dry cloth.
5. Dry your equipment in a ventilated, cool place.

NOTE

- For equipment with the symbol , all the listed cleaning and disinfecting agents are available for use.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Product Type</th>
<th>Active Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpet® D2 Surface Sanitizing Wipes</td>
<td>Wipes</td>
<td>Isopropyl Alcohol 58.6000%, Octyl Decyl Dimethyl Ammonium chloride 0.0075%, Dioctyl Dimethyl Ammonium Chloride 0.0030%</td>
</tr>
<tr>
<td>Clorox Dispatch® Hospital Cleaner Disinfectant</td>
<td>Wipes</td>
<td>Sodium Hypochlorite 0.65%</td>
</tr>
<tr>
<td>Cleaners with Bleach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clorox Healthcare® Bleach Germicidal Wipes</td>
<td>Wipes</td>
<td>Sodium Hypochlorite 0.55%</td>
</tr>
<tr>
<td>Clorox Healthcare® Hydrogen Peroxide Cleaner</td>
<td>Wipes</td>
<td>Hydrogen Peroxide 1.4%</td>
</tr>
<tr>
<td>Disinfectant Wipes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diversey Oxivir® TB Wipes</td>
<td>Wipes</td>
<td>Hydrogen Peroxide 0.5%</td>
</tr>
<tr>
<td>Metrex CaviWipes™</td>
<td>Wipes</td>
<td>Diisobutylphenoxyethoxethyl dimethyl benzyl ammonium chloride 0.28%, Isopropanol 17.2%</td>
</tr>
<tr>
<td>PDI Sani-Cloth® AF3 Germicidal Disposable Wipe</td>
<td>Wipes</td>
<td>n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.14%, n-Alkyl dimethyl benzyl ammonium chlorides 0.14%</td>
</tr>
<tr>
<td>PDI Sani-Cloth® Bleach Germicidal Disposable Wipe</td>
<td>Wipes</td>
<td>Sodium Hypochlorite 0.63%, other ingredients 99.37%</td>
</tr>
<tr>
<td>PDI Sani-Cloth® HB Germicidal Disposable Wipe</td>
<td>Wipes</td>
<td>n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.07%, n-Alkyl dimethyl benzyl ammonium chlorides 0.07%</td>
</tr>
<tr>
<td>PDI Sani-Cloth® Plus Germicidal Disposable Cloth</td>
<td>Wipes</td>
<td>n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.125%, n-Alkyl dimethyl benzyl ammonium chlorides 0.125%</td>
</tr>
<tr>
<td>PDI Super Sani-Cloth® Germicidal Disposable Wipe</td>
<td>Wipes</td>
<td>n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.25%, n-Alkyl dimethyl benzyl ammonium chlorides 0.25%, Isopropyl Alcohol 55.0%</td>
</tr>
<tr>
<td>VIRAGUARD® Hospital Surface Disinfectant Towelette</td>
<td>Wipes</td>
<td>Isopropyl Alcohol 70%, Other ingredients 30%</td>
</tr>
</tbody>
</table>

Product Name
Product Type
Active Ingredients
23.3.3 Disinfecting the Equipment and Mounting Kits

Disinfect the main unit, parameter modules, Modular Rack, Dock, folding hook, monitor handle, and bedrail hook as required in your hospital’s servicing schedule using the disinfecting agents listed in the table above. Cleaning equipment and mounting kits before disinfecting is recommended.

**CAUTION**

- Never use EtO or formaldehyde for disinfection.

23.4 Cleaning and Disinfecting the Accessories

For the NIBP air hose, Masimo SpO2 cable, and Nellcor SpO2 cable, you should clean and disinfect them using the cleaners and disinfectants and methods listed in this section. For other accessories, you should consult the instructions delivered with the accessories.

**CAUTION**

- Fluids entering the NIBP air hose can damage the equipment. When cleaning and/or disinfecting the NIBP air hose, prevent liquid from entering the hose.
- Periodically inspect the NIBP air hose and connector for signs of wear or deterioration. Replace the NIBP air hose if you detect a leak. Dispose of damaged NIBP air hose according to local laws for disposal of hospital waste.
- Never immerse or soak the accessories in any liquid.
- Never clean or disinfect the metallic connectors at either end of the accessories.
- Use only Mindray approved cleaners and disinfectants and methods listed in this section to clean or disinfect the accessories. Warranty does not cover damage caused by unapproved substances or methods.
- To avoid long term damage, the accessories should be disinfected only when necessary as determined by your hospital’s policy.

23.4.1 Approved Accessories Cleaning and Disinfecting Agents

The following table lists approved NIBP air hose cleaning and disinfecting agents:

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Product Type</th>
<th>Active Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropanol</td>
<td>Liquid</td>
<td>Isopropanol 70%</td>
</tr>
<tr>
<td>1-Propanol</td>
<td></td>
<td>1-Propanol 50%</td>
</tr>
<tr>
<td>Metrex CaviCide1™</td>
<td></td>
<td>Diisobutylphenoxyethoxyethyl dimethyl benzyl ammonium chloride 0.28%, Isopropanol 17.2%</td>
</tr>
<tr>
<td>Virex® TB</td>
<td></td>
<td>n-Alkyl dimethyl benzyl ammonium chlorides 0.105%, n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.105%</td>
</tr>
<tr>
<td>Rely+On™ Virkon® High Level Surface Disinfectant</td>
<td>Powder</td>
<td>Used as 1% solution Biocidal active: Pentapotassium bis (peroxymonosulphate) bis (sulphate)/(500g/kg), Contains dipotassium peroxodisulphate.</td>
</tr>
</tbody>
</table>
The following table lists approved Masimo SpO2 cable cleaning and disinfecting agents:

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Product Type</th>
<th>Active Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpet® D2 Surface Sanitizing Wipes</td>
<td>Wipes</td>
<td>Isopropyl Alcohol 58.6000%, Octyl Decyl Dimethyl Ammonium chloride 0.0075%, Dioctyl Dimethyl Ammonium Chloride 0.0030%</td>
</tr>
<tr>
<td>Clorox Dispatch® Hospital Cleaner Disinfectant Towels with Bleach</td>
<td></td>
<td>Sodium Hypochlorite 0.65%</td>
</tr>
<tr>
<td>Metrex CaviWipes™</td>
<td></td>
<td>Disobutylyphenoxypolyethoxyethyl dimethyl benzyl ammonium chloride 0.28%, Isopropanol 17.2%</td>
</tr>
<tr>
<td>PDI Sani-Cloth® AF3 Germicidal Disposable Wipe</td>
<td></td>
<td>n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.14%, n-Alkyl dimethyl benzyl ammonium chlorides 0.14%</td>
</tr>
<tr>
<td>PDI Sani-Cloth® Plus Germicidal Disposable Cloth</td>
<td></td>
<td>n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.125%, n-Alky dimethyl benzyl ammonium chlorides 0.125%</td>
</tr>
<tr>
<td>PDI Super Sani-Cloth® Germicidal Disposable Wipe</td>
<td></td>
<td>n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.25%, n-Alkyl dimethyl benzyl ammonium chlorides 0.25%, Isopropyl Alcohol 55.0%</td>
</tr>
<tr>
<td>VIRAGUARD® Hospital Surface Disinfectant Towelette</td>
<td></td>
<td>Isopropanol 70%, Other ingredients 30%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Product Type</th>
<th>Active Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropanol</td>
<td>Liquid</td>
<td>Isopropanol 70%</td>
</tr>
</tbody>
</table>
The following table lists approved Nellcor SpO2 cable cleaning and disinfecting agents:

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Product Type</th>
<th>Active Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hypochlorite bleach</td>
<td>Liquid</td>
<td>Sodium hypochlorite bleach 0.5%</td>
</tr>
<tr>
<td>Isopropanol</td>
<td></td>
<td>Isopropanol 70%</td>
</tr>
<tr>
<td>1-Propanol</td>
<td></td>
<td>1-Propanol 50%</td>
</tr>
<tr>
<td>Virex® TB</td>
<td></td>
<td>n-Alkyl dimethyl benzyl ammonium chlorides 0.105%, n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.105%</td>
</tr>
<tr>
<td>Rely+On™ Virkon® High Level Surface Disinfectant</td>
<td>Powder</td>
<td>Used as 1% solution  Biocidal active: Pentapotassium bis (peroxymonosulphate) bis (sulphate)(500g/kg), Contains dipotassium peroxodisulphate.</td>
</tr>
<tr>
<td>Clorox Dispatch® Hospital Cleaner Disinfectant Towels with Bleach</td>
<td>Wipes</td>
<td>Sodium Hypochlorite 0.65%</td>
</tr>
<tr>
<td>Clorox Healthcare* Bleach Germicidal Wipes</td>
<td></td>
<td>Sodium Hypochlorite 0.55%</td>
</tr>
<tr>
<td>Clorox Healthcare* Hydrogen Peroxide Cleaner Disinfectant Wipes</td>
<td></td>
<td>Hydrogen Peroxide 1.4%</td>
</tr>
<tr>
<td>Diversey Oxivir® TB Wipes</td>
<td></td>
<td>Hydrogen Peroxide 0.5%</td>
</tr>
<tr>
<td>PDI Super Sani-Cloth® Germicidal Disposable Wipe</td>
<td></td>
<td>n-Alkyl dimethyl ethylbenzyl ammonium chlorides 0.25%, n-Alkyl dimethyl benzyl ammonium chlorides 0.25%, Isopropyl Alcohol 55.0%</td>
</tr>
<tr>
<td>VIRAGUARD® Hospital Surface Disinfectant Towelette</td>
<td></td>
<td>Isopropanol 70%, Other ingredients 30%</td>
</tr>
</tbody>
</table>

### 23.4.2 Cleaning the Accessories

You should clean the accessories (NIBP air hose, Masimo SpO2 cable, and Nellcor SpO2 cable) on a regular basis. Before cleaning the accessories, consult your hospital’s regulations for cleaning the accessories.

To clean the accessories (NIBP air hose, Masimo SpO2 cable, and Nellcor SpO2 cable), follow this procedure:

1. Clean the accessories with wipes or a soft cloth moistened with one of the cleaning agents listed in 23.4.1 Approved Accessories Cleaning and Disinfecting Agents only.
2. Wipe off all the cleaning agent residue with a dry cloth.
3. Allow the accessories to air dry.

### 23.4.3 Disinfecting the Accessories

We recommend that the accessories (NIBP air hose, Masimo SpO2 cable, and Nellcor SpO2 cable) should be disinfected only when necessary as determined by your hospital’s policy, to avoid long term damage to the accessories. Cleaning the accessories before disinfecting is recommended.

### 23.5 Sterilization

Sterilization is not recommended for this equipment, related products, accessories, or supplies unless otherwise indicated in the Instructions for Use that accompany the products, accessories or supplies.
24 Maintenance

24.1 Maintenance Introduction
Regular maintenance is essential to ensure that the equipment continues to function properly. This chapter contains information on periodic testing and maintenance.

24.2 Maintenance Safety Information

WARNING
- To avoid electric shock, stop using the equipment if you find the housing is damaged, and contact your service representative.
- Failure on the part of the responsible individual hospital or institution using this equipment to implement a recommended maintenance schedule may cause undue equipment failure and possible health hazards.
- No modification of this equipment is allowed.
- This equipment contains no user serviceable parts.
- The safety checks or maintenance involving any disassembly of the equipment should be performed by professional service personnel. Otherwise, undue equipment failure and possible health hazards could result.
- Do not open batteries, heat batteries to above 60 °C, incinerate batteries, or short the battery terminals. Batteries may ignite, explode, leak or heat up, causing personal injury.
- The service personnel must be properly qualified and thoroughly familiar with the operation of the equipment.

CAUTION
- The equipment and accessories shall not be serviced or maintained while in use on a patient.
- If you discover a problem with any of the equipment, contact your service personnel or Mindray.
- Use and store the equipment within the specified temperature, humidity, and altitude ranges.
- When disposing of the packaging material, be sure to observe the applicable waste control regulations and keep it out of the reach of children.
- At the end of its service life, the equipment, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have any questions concerning disposal of the equipment, please contact Mindray.


24.3 Maintenance and Testing Schedule

Follow the maintenance and testing schedule or local regulations to perform testing and maintenance such as defined in section 24.5 Testing Methods and Procedures. Follow your hospital policy on cleaning and disinfecting the equipment before testing and maintenance.

The following table lists the maintenance and testing schedule:

<table>
<thead>
<tr>
<th>Test/Maintenance Item</th>
<th>Recommended Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance Tests</strong></td>
<td></td>
</tr>
<tr>
<td>Visual inspection</td>
<td>Every day, before first use.</td>
</tr>
<tr>
<td>Measurement module performance test and calibration</td>
<td>1. If you suspect that the measurement values are incorrect.</td>
</tr>
<tr>
<td></td>
<td>2. Follow any repairs or replacement of relevant module.</td>
</tr>
<tr>
<td></td>
<td>3. Once a year for CO₂ tests.</td>
</tr>
<tr>
<td></td>
<td>4. Once every two years for other parameter module performance tests.</td>
</tr>
<tr>
<td>Analog output test</td>
<td>If you suspect that the analog output function does not work properly.</td>
</tr>
<tr>
<td>Defibrillation synchronization test</td>
<td>If you suspect that the defibrillation synchronization function does not work properly.</td>
</tr>
<tr>
<td><strong>Electrical Safety Tests</strong></td>
<td></td>
</tr>
<tr>
<td>Electrical safety tests</td>
<td>Once every two years.</td>
</tr>
<tr>
<td><strong>Other Tests</strong></td>
<td></td>
</tr>
<tr>
<td>Power-on test</td>
<td>Before use.</td>
</tr>
<tr>
<td>Network printer tests</td>
<td>1. When first installed.</td>
</tr>
<tr>
<td></td>
<td>2. Following any repair or replacement of the printer.</td>
</tr>
<tr>
<td>Battery check</td>
<td>Functionality test</td>
</tr>
<tr>
<td></td>
<td>1. When first installed.</td>
</tr>
<tr>
<td></td>
<td>2. When battery is replaced.</td>
</tr>
<tr>
<td>Performance test</td>
<td>Every three months or if the battery runtime is reduced significantly.</td>
</tr>
</tbody>
</table>

24.4 Checking System Software Version

To view system software version information, select the **Main Menu** quick key → from the **System** column select **Version**.

You can check the detailed system software version, module hardware and software version, and firmware version only from the **Maintenance** dialog.

24.5 Testing Methods and Procedures

Except for the following maintenance tasks, all other test and maintenance tasks should be performed by Mindray-qualified service personnel only.

- Regular checks, including visual inspection and power-on test
- Printer tests
- Battery check

If your monitor needs a safety test and performance test, contact the service personnel.

24.5.1 Performing Visual Inspection

Visually inspect the equipment before its first use every day. If you find any signs of damage, remove the monitor from use and contact the service personnel.
Verify that the equipment meets the following requirements:

- Environment and power supply specifications are met.
- The monitor housing and display screen are free from cracks or other damage.
- The power cord is not damaged and the insulation is in good condition.
- Connectors, plugs, and cables are not damaged or kinked.
- Power cord and patient cables are securely connected to the equipment and modules.

24.5.2 Performing Power-on Test

The monitor automatically performs a power-on test at startup. Verify the following items during the power-on test:

- The equipment powers on properly.
- The alarm system works properly, denoted by alarm sounds and display of all 3 alarm light colors.
- The monitor displays properly.

24.5.3 Testing the Network Printer

To check the printer, follow this procedure:

1. Start a printing task to print waveforms and reports.
2. Check that the printer is properly connected and functions correctly.
3. Check that the printout is clear with no missing information.

24.5.4 Checking the Battery

For information on battery check, see 22.6.2 Checking Battery Performance.

24.6 NIBP Maintenance

24.6.1 NIBP Leakage Test

The NIBP leakage test checks the integrity of the system and of the valve. The NIBP leakage test should be performed once every two years or when you doubt the NIBP measurements. The NIBP leakage test should be performed by Mindray-qualified service personnel only.

24.6.2 NIBP Accuracy Test

The NIBP accuracy test should be performed once every two years or when you doubt the NIBP measurements. The NIBP accuracy test should be performed by Mindray-qualified service personnel only.

24.7 Disposing of the Monitor

Dispose of the monitor and its accessories when its service life is reached. Follow local regulations regarding the disposal of such product.

WARNING

- For disposal of parts and accessories, where not otherwise specified, follow local regulations regarding disposal of hospital waste.
The accessories listed in this chapter comply with the requirements of IEC 60601-1-2 when in use with the patient monitor. The accessory material that contacts the patients has undertaken the bio-compatibility test and is verified to be in compliance with ISO 10993-1. For details about the accessories, refer to the instructions for use provided with the accessory.

**WARNING**

- Use accessories specified in this chapter. Using other accessories may cause damage to the patient monitor or not meet the claimed specifications.
- Single-use accessories are not designed to be reused. Reuse may cause a risk of contamination and affect the measurement accuracy.

**CAUTION**

- The accessories may not meet the performance specifications if stored or used outside the specified temperature and humidity ranges. If accessory performance is degraded due to aging or environmental conditions, contact your service personnel.
- Check the accessories and their packages for any sign of damage. Do not use them if any damage is detected.
- Use the accessories before the expiration date if an expiration date is indicated.
- Discard disposable accessories according to hospital regulations.

**NOTE**

- This manual describes all the accessories that are validated for use. Not all accessories are available in every market.

### 25.1 ECG Accessories

#### 25.1.1 ECG Electrodes Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>31499224</td>
<td>0010-10-12304</td>
<td>Electrode, Kendall, pkg of 10</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>2245-50</td>
<td>9000-10-07469</td>
<td>ECG electrode, 3M, pkg of 50</td>
<td>Disposable</td>
<td>Pediatric</td>
</tr>
<tr>
<td>1050NPSMKittycat</td>
<td>0681-00-0098-01</td>
<td>NEO pre-wired electrode radio Opaque, pkg of 100</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>1051NPSMKittycat</td>
<td>0681-00-0098-02</td>
<td>NEO pre-wired electrode radio Translucent, pkg of 100</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
</tbody>
</table>
25.1.2 12-Pin Trunk Cables Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV6206</td>
<td>009-005266-00</td>
<td>ECG cable, 10’ (3.1 m), defibrillation-proof, for N/T</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EV6207</td>
<td>009-005267-00</td>
<td>ECG cable, 20’ (6.2 m), defibrillation-proof, for N/T</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EV6216</td>
<td>009-005268-00</td>
<td>ECG cable, 10’ (3.1 m), ESU-proof, for N/T</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EV6217</td>
<td>009-005269-00</td>
<td>ECG cable, 20’ (6.2 m), ESU-Proof, for N/T</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EV6208</td>
<td>040-003528-00</td>
<td>ECG cable, 10’ (3.1 m), 12-lead, defibrillation-proof, for N/T 5-lead leadwires</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
</tbody>
</table>

Note: 040-003528-00 uses 5-Lead N/T leadwires for the limb leads.

25.1.3 12-Pin Trunk Cables Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV6201</td>
<td>0010-30-42719</td>
<td>12Pin 3/5-Lead ECG trunk cable, defibrillation-proof</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EV6202</td>
<td>0010-30-42720</td>
<td>12Pin 3-Lead ECG trunk cable, defibrillation-proof</td>
<td>Reusable</td>
<td>Pediatric/Neonate</td>
</tr>
<tr>
<td>EV6203</td>
<td>0010-30-42721</td>
<td>12Pin 12-Lead trunk cable, defibrillation-proof</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EV6211</td>
<td>0010-30-42723</td>
<td>12Pin 3/5-Lead ECG trunk cable, ESU-proof</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EV6212</td>
<td>0010-30-42724</td>
<td>12Pin 3-Lead ECG trunk cable, ESU-proof</td>
<td>Reusable</td>
<td>Pediatric/Neonate</td>
</tr>
<tr>
<td>EV6222</td>
<td>040-000754-00</td>
<td>12Pin 3-Lead trunk cable, defibrillation-proof, DIN Conn</td>
<td>Reusable</td>
<td>Pediatric/Neonate</td>
</tr>
<tr>
<td>/</td>
<td>040-001416-00</td>
<td>12Pin 3/5-Lead ECG trunk cable, defibrillation-proof</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>/</td>
<td>009-003652-00</td>
<td>12Pin 3/5-Lead ECG trunk cable, ESU-proof</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
</tbody>
</table>

25.1.4 3-lead ECG Leadwires Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>EY6316B</td>
<td>009-004765-00</td>
<td>3-Lead, N/T, AHA, snap, 24”</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6305B</td>
<td>009-004766-00</td>
<td>3-Lead, N/T, AHA, snap, 36”</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6316A</td>
<td>009-004771-00</td>
<td>3-Lead, N/T, AHA, clip, 24”</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6305A</td>
<td>009-004772-00</td>
<td>3-Lead, N/T, AHA, clip, 36”</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6310B</td>
<td>009-004777-00</td>
<td>3-Lead, N/T, AHA, snap, 24”</td>
<td>Disposable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6310B</td>
<td>115-032954-00</td>
<td>3-Lead, N/T, AHA, snap, 24”, pkg of 20</td>
<td>Disposable</td>
<td>Adult/Pediatric</td>
</tr>
</tbody>
</table>
### 25.1.5 3-lead ECG Leadwires Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>EL6305A</td>
<td>0010-30-42896</td>
<td>3-Lead leadset, AHA, clip</td>
<td>Reusable</td>
<td>Neonate</td>
</tr>
<tr>
<td>EL6303A</td>
<td>0010-30-42731</td>
<td>3-Lead leadset, AHA, clip, Long</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EL6301B</td>
<td>0010-30-42734</td>
<td>3-Lead leadset, AHA, snap</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EL6311B</td>
<td>040-000146-00</td>
<td>3-Lead leadset, AHA, snap</td>
<td>Disposable</td>
<td>Pediatric/Neonate</td>
</tr>
<tr>
<td>EL6311A</td>
<td>040-000148-00</td>
<td>3-Lead leadset, AHA, clip</td>
<td>Disposable</td>
<td>Pediatric/Neonate</td>
</tr>
<tr>
<td>/</td>
<td>0012-00-1503-05</td>
<td>3-Lead leadset, snap, 24&quot; (61.0 cm), AAMI</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>/</td>
<td>0012-00-1503-06</td>
<td>3-Lead leadset, snap, 36&quot; (101.6 cm), AAMI</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>/</td>
<td>0012-00-1514-05</td>
<td>3-Lead leadset, clip, 24&quot; (61.0 cm), AAMI</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>/</td>
<td>0012-00-1514-06</td>
<td>3-Lead leadset, clip, 36&quot; (101.6 cm), AAMI</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
</tbody>
</table>

### 25.1.6 5-lead ECG Leadwires Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>EY6511B</td>
<td>009-004782-00</td>
<td>5-Lead, N/T, AHA, snap, 24&quot;</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6512B</td>
<td>009-004783-00</td>
<td>5-Lead, N/T, AHA, snap, 36&quot;</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6511A</td>
<td>009-004786-00</td>
<td>5-Lead, N/T, AHA, pinch, 24&quot;</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6512A</td>
<td>009-004787-00</td>
<td>5-Lead, N/T, AHA, pinch, 36&quot;</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6507B</td>
<td>009-004790-00</td>
<td>5-Lead, N/T, AHA, snap, 24&quot;</td>
<td>Disposable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6507B</td>
<td>115-032955-00</td>
<td>5-Lead, N/T, AHA, snap, 24&quot;, pkg of 20</td>
<td>Disposable</td>
<td>Adult/Pediatric</td>
</tr>
</tbody>
</table>

### 25.1.7 5-lead ECG Leadwires Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>EL6503A</td>
<td>0010-30-42729</td>
<td>5-Lead leadset, AHA, clip, Long</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EL6501B</td>
<td>0010-30-42735</td>
<td>5-Lead leadset, AHA, snap</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EL6501A</td>
<td>0010-30-42727</td>
<td>5-Lead leadset, AHA, clip</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>/</td>
<td>0012-00-1503-02</td>
<td>5-Lead leadset, snap, 24&quot; (61.0 cm), AAMI</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>/</td>
<td>0012-00-1503-03</td>
<td>5-Lead leadset, snap, 36&quot; (101.6 cm), AAMI</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>/</td>
<td>0012-00-1514-02</td>
<td>5-Lead leadset, clip, 24&quot; (61.0 cm), AAMI</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>/</td>
<td>0012-00-1514-03</td>
<td>5-Lead leadset, clip, 36&quot; (101.6 cm), AAMI</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
</tbody>
</table>
25.1.8 6-lead ECG Leadwires Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>EY6601B</td>
<td>009-004794-00</td>
<td>6-Lead, N/T, AHA, snap, 24”</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6602B</td>
<td>009-004795-00</td>
<td>6-Lead, N/T, AHA, snap, 36”</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6601A</td>
<td>009-004798-00</td>
<td>6-Lead, N/T, AHA, pinch, 24”</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EY6602A</td>
<td>009-004799-00</td>
<td>6-Lead, N/T, AHA, pinch, 36”</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
</tbody>
</table>

25.1.9 12-lead ECG Chest Leadwires Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>EL6803A</td>
<td>0010-30-42904</td>
<td>12-Lead leadset, chest, AHA, clip</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EL6803B</td>
<td>0010-30-42908</td>
<td>12-Lead leadset, chest, AHA, snap</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
</tbody>
</table>

25.1.10 12-lead ECG Leadwires Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>EL6801A</td>
<td>0010-30-42902</td>
<td>12-Lead leadset, limb, AHA, clip</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>EL6801B</td>
<td>0010-30-42906</td>
<td>12-Lead leadset, limb, AHA, snap</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
</tbody>
</table>

25.2 SpO₂ Accessories

Wavelength emitted by the sensors is between 600 nm and 1000 nm. The maximum photic output consumption of the sensor is less than 18 mW.

The information about the wavelength range and maximum photic output consumption can be especially useful to clinicians, for example, when photodynamic therapy is performed.

25.2.1 Extension Cables and Adapter Cables Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>572A</td>
<td>0010-20-42712</td>
<td>8-pin SpO₂ extension cable, Nellcor</td>
<td>Reusable</td>
<td>/</td>
</tr>
<tr>
<td>583A</td>
<td>040-003310-00</td>
<td>8-pin, RD SET, Masimo</td>
<td>Reusable</td>
<td>/</td>
</tr>
<tr>
<td>4089</td>
<td>040-003381-00</td>
<td>RD to LNCS adapter cable, Masimo</td>
<td>Reusable</td>
<td>/</td>
</tr>
<tr>
<td>4092</td>
<td>040-003426-00</td>
<td>LNCS to RD adapter, Masimo</td>
<td>Reusable</td>
<td>/</td>
</tr>
</tbody>
</table>

25.2.2 Extension Cables and Adapter Cables Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>582A</td>
<td>115-020768-00</td>
<td>8-pin SpO₂ extension cable, Masimo</td>
<td>Reusable</td>
<td>/</td>
</tr>
</tbody>
</table>
### 25.2.3 Masimo SpO₂ RD Set Sensors Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>4050</td>
<td>040-003376-00</td>
<td>SpO₂ sensor, RD SET DCI</td>
<td>Reusable</td>
<td>Adult (&gt;30 kg)</td>
</tr>
<tr>
<td>4051</td>
<td>040-003377-00</td>
<td>SpO₂ sensor, RD SET DCI</td>
<td>Reusable</td>
<td>Pediatric (10-50 kg)</td>
</tr>
<tr>
<td>4053</td>
<td>040-003380-00</td>
<td>SpO₂ sensor, RD Set TC-I, tip-clip ear sensor, 3ft</td>
<td>Reusable</td>
<td>Adult (&gt;30 kg)</td>
</tr>
<tr>
<td>4000</td>
<td>040-003382-00</td>
<td>SpO₂ sensor, RD SET Adt, adhesive, pkg of 20</td>
<td>Disposable</td>
<td>Adult (&gt;30 kg)</td>
</tr>
<tr>
<td>4001</td>
<td>040-003383-00</td>
<td>SpO₂ sensor, RD SET PDT, adhesive, pkg of 20</td>
<td>Disposable</td>
<td>Pediatric (10 to 50 kg)</td>
</tr>
<tr>
<td>4002</td>
<td>040-003384-00</td>
<td>SpO₂ sensor, RD Set Inf, adhesive, pkg of 20</td>
<td>Disposable</td>
<td>Infant (3 to 20 kg)</td>
</tr>
<tr>
<td>4003</td>
<td>040-003385-00</td>
<td>SpO₂ sensor, RD Set Neo, adhesive, pkg of 20</td>
<td>Disposable</td>
<td>Neonatal/Adult (&lt;3Kg or &gt;40Kg)</td>
</tr>
<tr>
<td>4004</td>
<td>040-003386-00</td>
<td>SpO₂ sensor, RD Set NeoPt, adhesive, pkg of 20</td>
<td>Disposable</td>
<td>Neonate (&lt;1 kg)</td>
</tr>
<tr>
<td>4005</td>
<td>040-003387-00</td>
<td>SpO₂ sensor, RD Set NeoPt-500, non-adhesive, pkg of 20</td>
<td>Disposable</td>
<td>Neonate (&lt;1 kg)</td>
</tr>
</tbody>
</table>

### 25.2.4 Masimo SpO₂ LNCS Sensors Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNCS DCI</td>
<td>0010-10-42600</td>
<td>SpO₂ sensor, finger-clip</td>
<td>Reusable</td>
<td>Adult (&gt;30 kg)</td>
</tr>
<tr>
<td>LNCS DCIP</td>
<td>0010-10-42634</td>
<td>SpO₂ sensor, finger-clip</td>
<td>Reusable</td>
<td>Pediatric (10-50 kg)</td>
</tr>
<tr>
<td>LNCS Yi</td>
<td>0010-10-43016</td>
<td>SpO₂ sensor, multisite</td>
<td>Reusable</td>
<td>Adult/Pediatric/Neonate</td>
</tr>
<tr>
<td>LNCS NeoPt-L</td>
<td>0010-10-42626</td>
<td>SpO₂ sensor</td>
<td>Disposable</td>
<td>Neonate (&lt;1 kg)</td>
</tr>
<tr>
<td>LNCS Neo-L</td>
<td>0010-10-42627</td>
<td>SpO₂ sensor</td>
<td>Disposable</td>
<td>Neonate/Adult (&lt;3 kg or &gt;40 kg)</td>
</tr>
<tr>
<td>LNCS Inf-L</td>
<td>0010-10-42628</td>
<td>SpO₂ sensor</td>
<td>Disposable</td>
<td>Infant (3-20 kg)</td>
</tr>
<tr>
<td>LNCS Pdtx</td>
<td>0010-10-42629</td>
<td>SpO₂ sensor</td>
<td>Disposable</td>
<td>Pediatric (10-50 kg)</td>
</tr>
<tr>
<td>LNCS Adtx</td>
<td>0010-10-42630</td>
<td>SpO₂ sensor</td>
<td>Disposable</td>
<td>Adult (&gt;30 kg)</td>
</tr>
<tr>
<td>LNCS Adtx</td>
<td>0600-00-0121</td>
<td>SpO₂ sensor, finger-clip, 20 pcs/box</td>
<td>Disposable</td>
<td>Adult (&gt;30 kg)</td>
</tr>
<tr>
<td>LNCS Pdtx</td>
<td>0600-00-0122</td>
<td>SpO₂ sensor, finger-clip, 20 pcs/box</td>
<td>Disposable</td>
<td>Pediatric (10-50 kg)</td>
</tr>
<tr>
<td>LNCS DCI</td>
<td>0600-00-0126</td>
<td>SpO₂ sensor, finger-clip</td>
<td>Reusable</td>
<td>Adult (&gt;30 kg)</td>
</tr>
<tr>
<td>LNCS DCIP</td>
<td>0600-00-0127</td>
<td>SpO₂ sensor, finger-clip</td>
<td>Reusable</td>
<td>Pediatric (10-50 kg)</td>
</tr>
<tr>
<td>LNCS NeoPt</td>
<td>0600-00-0156</td>
<td>SpO₂ sensor, finger-clip</td>
<td>Disposable</td>
<td>Neonate (&lt;1 Kg)</td>
</tr>
<tr>
<td>LNCS Neo-L</td>
<td>0600-00-0157</td>
<td>SpO₂ sensor, 20 pcs/box</td>
<td>Disposable</td>
<td>Neonate/Adult (&lt;3 kg or &gt; 40 kg)</td>
</tr>
<tr>
<td>LNCS Inf</td>
<td>0600-00-0158</td>
<td>SpO₂ sensor, 20 pcs/box</td>
<td>Disposable</td>
<td>Infant (3-20 kg)</td>
</tr>
</tbody>
</table>
### 25.2.5 Nellcor SpO₂ Sensors Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS100A</td>
<td>9000-10-05161</td>
<td>SpO₂ sensor, finger-clip</td>
<td>Reusable</td>
<td>Adult</td>
</tr>
<tr>
<td>D-YS</td>
<td>0010-10-12476</td>
<td>SpO₂ sensor, with wraps</td>
<td>Reusable</td>
<td>/</td>
</tr>
<tr>
<td>OXI-P/I</td>
<td>9000-10-07308</td>
<td>SpO₂ sensor, finger, band</td>
<td>Reusable</td>
<td>Pediatric/Infant</td>
</tr>
<tr>
<td>OXI-A/N</td>
<td>9000-10-07336</td>
<td>SpO₂ sensor, finger/foot, band</td>
<td>Reusable</td>
<td>Adult/Neonate</td>
</tr>
<tr>
<td>MAXAI</td>
<td>0010-10-12202</td>
<td>SpO₂ sensor, 24 pcs/box</td>
<td>Disposable</td>
<td>Adult (&gt;30 kg)</td>
</tr>
<tr>
<td>MAXPI</td>
<td>0010-10-12203</td>
<td>SpO₂ sensor, 24 pcs/box</td>
<td>Disposable</td>
<td>Pediatric (10-50 Kg)</td>
</tr>
<tr>
<td>MAXII</td>
<td>0010-10-12204</td>
<td>SpO₂ sensor, 24 pcs/box</td>
<td>Disposable</td>
<td>Infant (3-20 Kg)</td>
</tr>
<tr>
<td>MAXNI</td>
<td>0010-10-12205</td>
<td>SpO₂ sensor, 24 pcs/box</td>
<td>Disposable</td>
<td>Adult/Neonate (&lt;3 kg or &gt;40 kg)</td>
</tr>
</tbody>
</table>

### 25.3 Temp Accessories

#### 25.3.1 Temp Cable Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR420B</td>
<td>040-001235-00</td>
<td>2-pin Temperature adapter cable</td>
<td>Reusable</td>
<td>/</td>
</tr>
</tbody>
</table>

#### 25.3.2 Temp Cable Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR420B</td>
<td>0011-30-37391</td>
<td>2-pin, extension cable</td>
<td>Reusable</td>
<td>/</td>
</tr>
</tbody>
</table>

#### 25.3.3 Temp Probes Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR401B</td>
<td>0011-30-37392</td>
<td>Temperature probe, endocavity</td>
<td>Reusable</td>
<td>Adult</td>
</tr>
<tr>
<td>MR402B</td>
<td>0011-30-37394</td>
<td>Temperature probe, endocavity</td>
<td>Reusable</td>
<td>Pediatric/Infant</td>
</tr>
<tr>
<td>MR403B</td>
<td>0011-30-37393</td>
<td>Temperature probe, skin surface</td>
<td>Reusable</td>
<td>Adult</td>
</tr>
<tr>
<td>MR404B</td>
<td>0011-30-37395</td>
<td>Temperature probe, skin surface</td>
<td>Reusable</td>
<td>Pediatric/Infant</td>
</tr>
<tr>
<td>MR411</td>
<td>040-003292-00</td>
<td>Temperature probe, esophageal/rectal, 9FR</td>
<td>Disposable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>MR411</td>
<td>040-003294-00</td>
<td>Temperature probe, esophageal/rectal, 9FR, pkg of 20</td>
<td>Disposable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>MR412</td>
<td>040-003293-00</td>
<td>Temp probe, skin surface</td>
<td>Disposable</td>
<td>All</td>
</tr>
<tr>
<td>MR412</td>
<td>040-003295-00</td>
<td>Temp probe, skin surface, pkg of 20</td>
<td>Disposable</td>
<td>All</td>
</tr>
<tr>
<td>/</td>
<td>0206-03-0112-02</td>
<td>PROBE,D TEMPE5400-12 (box of 20)</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>/</td>
<td>0206-03-0118-02</td>
<td>PROBE,D TEMPE5400-18 (box of 20)</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>/</td>
<td>0206-03-0209-02</td>
<td>PROBE,D TEMPER 400-9 (box of 20)</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>/</td>
<td>0206-03-0212-02</td>
<td>PROBE,D TEMPER 400-12 (box of 20)</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
</tbody>
</table>
### Temp Probes Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR411</td>
<td>0011-30-90446</td>
<td>Disposable temperature probe, esophageal</td>
<td>Disposable</td>
<td>All</td>
</tr>
<tr>
<td>MR412</td>
<td>0011-30-90447</td>
<td>Disposable temperature probe, skin</td>
<td>Disposable</td>
<td>All</td>
</tr>
</tbody>
</table>

### NIBP Accessories

#### NIBP Hoses Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM1903</td>
<td>6200-30-09688</td>
<td>NIBP hose, inbuilt connector, 3m</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>CM1901</td>
<td>6200-30-11560</td>
<td>NIBP hose, inbuilt connector, 3m</td>
<td>Reusable</td>
<td>Neonate</td>
</tr>
</tbody>
</table>

#### Cuffs Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM1301</td>
<td>115-027713-00</td>
<td>Cuff, 10-19 cm, bladderless</td>
<td>Reusable</td>
<td>Infant</td>
</tr>
<tr>
<td>CM1302</td>
<td>115-027714-00</td>
<td>Cuff, 18-26 cm, bladderless</td>
<td>Reusable</td>
<td>Small Adult</td>
</tr>
<tr>
<td>CM1303</td>
<td>115-027715-00</td>
<td>Cuff, 25-35 cm, bladderless</td>
<td>Reusable</td>
<td>Adult</td>
</tr>
<tr>
<td>CM1304</td>
<td>115-027716-00</td>
<td>Cuff, 33-47 cm, bladderless</td>
<td>Reusable</td>
<td>Adult</td>
</tr>
<tr>
<td>CM1305</td>
<td>115-027717-00</td>
<td>Cuff, 46-66 cm, bladderless</td>
<td>Reusable</td>
<td>Adult thigh</td>
</tr>
<tr>
<td>CM1306</td>
<td>115-027718-00</td>
<td>Cuff, 24-35 cm, bladderless</td>
<td>Reusable</td>
<td>Adult</td>
</tr>
<tr>
<td>CM1307</td>
<td>115-027719-00</td>
<td>Cuff, 33-47 cm, bladderless</td>
<td>Reusable</td>
<td>Adult</td>
</tr>
<tr>
<td>CM1501</td>
<td>115-027556-00</td>
<td>Cuff, 10-19 cm, bladderless</td>
<td>Disposable</td>
<td>Child</td>
</tr>
<tr>
<td>CM1501</td>
<td>115-027563-00</td>
<td>Cuff, 10-19 cm, bladderless, pkg of 10</td>
<td>Disposable</td>
<td>Child</td>
</tr>
<tr>
<td>CM1502</td>
<td>115-027557-00</td>
<td>Cuff, 18-26 cm, bladderless</td>
<td>Disposable</td>
<td>Small adult</td>
</tr>
<tr>
<td>CM1502</td>
<td>115-027564-00</td>
<td>Cuff, 18-26 cm, bladderless, pkg of 10</td>
<td>Disposable</td>
<td>Small adult</td>
</tr>
<tr>
<td>CM1503</td>
<td>115-027558-00</td>
<td>Cuff, 25-35 cm, bladderless</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>CM1504</td>
<td>115-027559-00</td>
<td>Cuff, 33-47 cm, bladderless</td>
<td>Disposable</td>
<td>Large adult</td>
</tr>
<tr>
<td>CM1504</td>
<td>115-027566-00</td>
<td>Cuff, 33-47 cm, bladderless, pkg of 10</td>
<td>Disposable</td>
<td>Large adult</td>
</tr>
<tr>
<td>CM1505</td>
<td>115-027560-00</td>
<td>Cuff, 46-66 cm, bladderless</td>
<td>Disposable</td>
<td>Adult thigh</td>
</tr>
<tr>
<td>CM1505</td>
<td>115-027567-00</td>
<td>Cuff, 46-66 cm, bladderless, pkg of 10</td>
<td>Disposable</td>
<td>Adult thigh</td>
</tr>
</tbody>
</table>
### 25.5 IBP Accessories

#### 25.5.1 IBP Accessories Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM1506</td>
<td>115-027561-00</td>
<td>Cuff, 25-35 cm, bladderless, long</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>CM1506</td>
<td>115-027568-00</td>
<td>Cuff, 25-35 cm, bladderless, pkg of 10, long</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>CM1507</td>
<td>115-027562-00</td>
<td>Cuff, 33-47 cm, bladderless, long</td>
<td>Disposable</td>
<td>Large adult</td>
</tr>
<tr>
<td>CM1507</td>
<td>115-027569-00</td>
<td>Cuff, 33-47 cm, bladderless, pkg of 10, long</td>
<td>Disposable</td>
<td>Large adult</td>
</tr>
<tr>
<td>CM1500A</td>
<td>001B-30-70677</td>
<td>Cuff, 3.1-5.7 cm</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>CM1500A</td>
<td>001B-30-70692</td>
<td>Cuff, 3.1-5.7 cm, pkg of 20</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>CM1500B</td>
<td>001B-30-70678</td>
<td>Cuff, 4.3-8.0 cm</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>CM1500B</td>
<td>001B-30-70693</td>
<td>Cuff, 4.3-8.0 cm, pkg of 20</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>CM1500C</td>
<td>001B-30-70679</td>
<td>Cuff, 5.8-10.9 cm</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>CM1500C</td>
<td>001B-30-70694</td>
<td>Cuff, 5.8-10.9 cm, pkg of 20</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>CM1500D</td>
<td>001B-30-70680</td>
<td>Cuff, 7.1-13.1 cm</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>CM1500D</td>
<td>001B-30-70695</td>
<td>Cuff, 7.1-13.1 cm, pkg of 20</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>/</td>
<td>115-031807-00</td>
<td>Cuff starter kit, bladderless</td>
<td>Reusable</td>
<td>Child/Small adult/ Adult/Adult thigh</td>
</tr>
</tbody>
</table>

#### 25.5.2 IBP Accessories Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM2202</td>
<td>001C-30-70757</td>
<td>12 Pin IBP cable, Argon</td>
<td>Reusable</td>
<td>/</td>
</tr>
<tr>
<td>IM2201</td>
<td>001C-30-70759</td>
<td>12 Pin IBP cable, ICU Medical</td>
<td>Reusable</td>
<td>/</td>
</tr>
<tr>
<td>IM2204</td>
<td>040-001029-00</td>
<td>IBP extended cable with dual-receptacle</td>
<td>Reusable</td>
<td>/</td>
</tr>
<tr>
<td>/</td>
<td>0010-21-12179</td>
<td>12 Pin IBP cable, Edwards</td>
<td>Reusable</td>
<td>/</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>DT-4812</td>
<td>6000-10-02107</td>
<td>Disposable transducer kit, Argon</td>
<td>Disposable</td>
<td>/</td>
</tr>
<tr>
<td>682275</td>
<td>0010-10-12156</td>
<td>Mounting background and accessory for IBP transducer, Argon</td>
<td>Reusable</td>
<td>/</td>
</tr>
<tr>
<td>42584</td>
<td>0010-10-42638</td>
<td>IBP transducer, ICU Medical</td>
<td>Disposable</td>
<td>/</td>
</tr>
<tr>
<td>42602</td>
<td>M90-000133---</td>
<td>Mounting background and accessory for IBP transducer, ICU Medical</td>
<td>Reusable</td>
<td>/</td>
</tr>
<tr>
<td>42394</td>
<td>M90-000134---</td>
<td>Mounting clamp for IBP transducer (send with the cable), ICU Medical</td>
<td>Reusable</td>
<td>/</td>
</tr>
</tbody>
</table>
### 25.5.3 ICP Accessories Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>82-6653</td>
<td>040-002336-00</td>
<td>Codman ICP sensor kit, Johnson &amp; Johnson, pkg of 1</td>
<td>Disposable</td>
<td>/</td>
</tr>
<tr>
<td>CP12601</td>
<td>009-005460-00</td>
<td>12-pin ICP cable</td>
<td>Reusable</td>
<td>/</td>
</tr>
</tbody>
</table>

### 25.6 CO₂ Accessories

#### 25.6.1 Sidestream CO₂ Accessories Available for Purchase

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000</td>
<td>M02A-10-25937</td>
<td>CO₂ Nasal sample cannula, 7” line</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>4000</td>
<td>115-043001-00</td>
<td>CO₂ Nasal sample cannula, 7” line, pkg of 25</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>4100</td>
<td>M02A-10-25938</td>
<td>CO₂ Nasal sample cannula, 7” line</td>
<td>Disposable</td>
<td>Pediatric</td>
</tr>
<tr>
<td>4100</td>
<td>115-043002-00</td>
<td>CO₂ Nasal sample cannula, 7” line, pkg of 25</td>
<td>Disposable</td>
<td>Pediatric</td>
</tr>
<tr>
<td>4200</td>
<td>M02B-10-64509</td>
<td>CO₂ Nasal sample cannula, 7” line</td>
<td>Disposable</td>
<td>Neonatal</td>
</tr>
<tr>
<td>4200</td>
<td>115-043003-00</td>
<td>CO₂ Nasal sample cannula, 7” line, pkg of 25</td>
<td>Disposable</td>
<td>Neonatal</td>
</tr>
<tr>
<td>60-15200-00</td>
<td>9200-10-10533</td>
<td>Sampling line, 2.5 m</td>
<td>Disposable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>60-15200-00</td>
<td>115-043017-00</td>
<td>Sampling line, 2.5 m, pkg of 25</td>
<td>Disposable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>60-15300-00</td>
<td>9200-10-10555</td>
<td>Sampling line, 2.5 m</td>
<td>Disposable</td>
<td>Neonatal</td>
</tr>
<tr>
<td>60-15300-00</td>
<td>115-043018-00</td>
<td>Sampling line, 2.5 m, pkg of 25</td>
<td>Disposable</td>
<td>Neonatal</td>
</tr>
<tr>
<td>60-14100-00</td>
<td>9000-10-07486</td>
<td>Dryline airway adapter, straight</td>
<td>Disposable</td>
<td>Adu/Ped</td>
</tr>
<tr>
<td>60-14100-00</td>
<td>115-043020-00</td>
<td>Dryline airway adapter, straight, pkg of 10</td>
<td>Disposable</td>
<td>Adu/Ped</td>
</tr>
<tr>
<td>040-001187-00</td>
<td>040-001187-00</td>
<td>Airway Adapter</td>
<td>Disposable</td>
<td>Neonatal</td>
</tr>
<tr>
<td>040-001187-00</td>
<td>115-043019-00</td>
<td>Airway Adapter pkg of 10</td>
<td>Disposable</td>
<td>Neonatal</td>
</tr>
<tr>
<td>60-14200-00</td>
<td>9000-10-07487</td>
<td>Dryline airway adapter, elbow</td>
<td>Disposable</td>
<td>/</td>
</tr>
<tr>
<td>60-14200-00</td>
<td>115-043021-00</td>
<td>Dryline airway adapter, elbow pkg of 10</td>
<td>Disposable</td>
<td>/</td>
</tr>
<tr>
<td>100-000080-00</td>
<td>115-058733-00</td>
<td>Watertrap, DRYLINE II, pkg of 10</td>
<td>Reusable</td>
<td>Adult/Pediatric</td>
</tr>
<tr>
<td>100-000081-00</td>
<td>115-058734-00</td>
<td>Watertrap, DRYLINE II, pkg of 10</td>
<td>Reusable</td>
<td>Neonatal</td>
</tr>
</tbody>
</table>

#### 25.6.2 Microstream CO₂ Accessories Intended for Sale

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>/</td>
<td>045-003134-00</td>
<td>CO₂ adapter</td>
<td>Reusable</td>
</tr>
</tbody>
</table>
25.6.3 Microstream CO₂ Accessories Also Compatible

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
<th>Description</th>
<th>Usage</th>
<th>Applicable patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>XS04620</td>
<td>0010-10-42560</td>
<td>FilterLine Set</td>
<td>Disposable</td>
<td>Adult, pediatric</td>
</tr>
<tr>
<td>XS04624</td>
<td>0010-10-42561</td>
<td>FilterLine H Set</td>
<td>Disposable</td>
<td>Adult, pediatric</td>
</tr>
<tr>
<td>006324</td>
<td>0010-10-42562</td>
<td>FilterLine H Set</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>007768</td>
<td>0010-10-42563</td>
<td>FilterLine Set, long</td>
<td>Disposable</td>
<td>Adult, pediatric</td>
</tr>
<tr>
<td>007737</td>
<td>0010-10-42564</td>
<td>FilterLine H Set, long</td>
<td>Disposable</td>
<td>Adult, pediatric</td>
</tr>
<tr>
<td>007738</td>
<td>0010-10-42565</td>
<td>FilterLine H Set, long</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>009818</td>
<td>0010-10-42566</td>
<td>S CapnoLine Plus</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>007266</td>
<td>0010-10-42567</td>
<td>Smart CapnoLine</td>
<td>Disposable</td>
<td>Pediatric</td>
</tr>
<tr>
<td>009822</td>
<td>0010-10-42568</td>
<td>S CapnoLine Plus O₂</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>007269</td>
<td>0010-10-42569</td>
<td>Smart CapnoLine O₂</td>
<td>Disposable</td>
<td>Pediatric</td>
</tr>
<tr>
<td>009826</td>
<td>0010-10-42570</td>
<td>S CapnoLine Plus O₂, long</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>007743</td>
<td>0010-10-42571</td>
<td>S CapnoLine O₂, long</td>
<td>Disposable</td>
<td>Pediatric</td>
</tr>
<tr>
<td>008177</td>
<td>0010-10-42572</td>
<td>CapnoLine H</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>008178</td>
<td>0010-10-42573</td>
<td>CapnoLine H</td>
<td>Disposable</td>
<td>Pediatric</td>
</tr>
<tr>
<td>008179</td>
<td>0010-10-42574</td>
<td>CapnoLine H</td>
<td>Disposable</td>
<td>Neonate</td>
</tr>
<tr>
<td>008180</td>
<td>0010-10-42575</td>
<td>CapnoLine H O₂</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>008181</td>
<td>0010-10-42576</td>
<td>CapnoLine H O₂</td>
<td>Disposable</td>
<td>Pediatric</td>
</tr>
<tr>
<td>008174</td>
<td>0010-10-42577</td>
<td>NIV-Line</td>
<td>Disposable</td>
<td>Adult</td>
</tr>
<tr>
<td>008175</td>
<td>0010-10-42578</td>
<td>NIV-Line</td>
<td>Disposable</td>
<td>Pediatric</td>
</tr>
</tbody>
</table>

25.7 External Modules

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>115-053711-00</td>
<td>Sidestream CO₂ module, with neonatal accessories</td>
</tr>
<tr>
<td>115-049134-00</td>
<td>Sidestream CO₂ module, with adult and pediatric accessories</td>
</tr>
<tr>
<td>115-049136-00</td>
<td>Sidestream CO₂ module, integrating O₂ (paramagnetic) monitoring, with adult and pediatric accessories</td>
</tr>
<tr>
<td>115-053712-00</td>
<td>Sidestream CO₂ module, integrating O₂ (paramagnetic) monitoring, with neonatal accessories</td>
</tr>
<tr>
<td>6800-30-50820</td>
<td>Microstream CO₂ module, with accessories</td>
</tr>
</tbody>
</table>

25.8 Mount and Mounting Accessories

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>115-028320-00</td>
<td>Monitor handle</td>
</tr>
<tr>
<td>115-048378-00</td>
<td>Modular Rack kit</td>
</tr>
<tr>
<td>115-054849-00</td>
<td>Dock and pole mount kit</td>
</tr>
<tr>
<td>115-054851-00</td>
<td>Modular Rack and folding hook kit</td>
</tr>
</tbody>
</table>
### 25.9 Miscellaneous Accessories

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>115-048990-00</td>
<td>Bedrail hook kit</td>
</tr>
<tr>
<td>045-001229-00</td>
<td>LCD wall-mount bracket</td>
</tr>
<tr>
<td>045-001230-00</td>
<td>Pole mounting kit</td>
</tr>
<tr>
<td>045-002198-00</td>
<td>Dock wall mount bracket</td>
</tr>
<tr>
<td>045-000931-00</td>
<td>GCX M series wall mount with quick release</td>
</tr>
<tr>
<td>045-001228-00</td>
<td>N1/T1 docking station wall-mount (for LCD)</td>
</tr>
<tr>
<td>034-000454-00</td>
<td>GCX M series arm, 16&quot;, with 6&quot; riser</td>
</tr>
<tr>
<td>034-000457-00</td>
<td>GCX M series 12&quot; pivot arm</td>
</tr>
<tr>
<td>034-000456-00</td>
<td>GCX VHM variable height arm</td>
</tr>
<tr>
<td>045-000934-00</td>
<td>Keyboard wall-mount bracket</td>
</tr>
<tr>
<td>045-000924-00</td>
<td>Rolling stand with quick release mount</td>
</tr>
<tr>
<td>115-050757-00</td>
<td>Hook kit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>009-009766-00</td>
<td>N Series to N1/T1 docking station cable, 20 m</td>
</tr>
<tr>
<td>009-006594-00</td>
<td>N Series to N1/T1 docking station cable, 10 m</td>
</tr>
<tr>
<td>009-005123-00</td>
<td>N Series to N1/T1 docking station cable, 4 m</td>
</tr>
<tr>
<td>009-006593-00</td>
<td>N Series to N1/T1 docking station cable, 2 m</td>
</tr>
<tr>
<td>115-048379-00</td>
<td>Dock, with power cord</td>
</tr>
<tr>
<td>115-048384-00</td>
<td>Transport Dock</td>
</tr>
<tr>
<td>009-005391-00</td>
<td>MPM analog output and defib sync cable</td>
</tr>
<tr>
<td>023-001788-00</td>
<td>External display, 21.5&quot;</td>
</tr>
<tr>
<td>023-001566-00</td>
<td>HP LaserJet Enterprise M608n, black and white</td>
</tr>
<tr>
<td>115-048139-00</td>
<td>AC adapter kit</td>
</tr>
<tr>
<td>115-049427-00</td>
<td>Lithium battery kit</td>
</tr>
<tr>
<td>DA8K-10-14452</td>
<td>Power cord</td>
</tr>
<tr>
<td>115-048417-00</td>
<td>N1 Accessories Storage Box</td>
</tr>
<tr>
<td>023-000524-00</td>
<td>Wireless keyboard and mouse set</td>
</tr>
<tr>
<td>023-000525-00</td>
<td>Wired keyboard and mouse set</td>
</tr>
<tr>
<td>023-000247-00</td>
<td>Keyboard, wired USB connector, black</td>
</tr>
<tr>
<td>023-000248-00</td>
<td>Mouse, wired USB connector, black</td>
</tr>
<tr>
<td>115-039575-00</td>
<td>2D Barcode reader, HS-1M, JADAK</td>
</tr>
<tr>
<td>115-039635-00</td>
<td>2D Barcode reader, HS-1R, JADAK</td>
</tr>
<tr>
<td>042-007382-00</td>
<td>Cable management hook</td>
</tr>
</tbody>
</table>
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Product Specifications

A.1 Monitor Safety Specifications

The monitor is classified, according to IEC 60601-1: 2005.

| Degree of protection against electrical shock | Type CF defibrillation proof for ECG, RESP, TEMP, IBP, SpO₂, and NIBP
| Type BF defibrillation proof for CO₂ |
| Degree of protection against electrical shock | Class I |
| Ingress Protection | N1 monitor: IP44 (protected against ingress of foreign objects no less than 1.0 mm, and against access to hazardous parts with wire; protect against harmful effects of splashing water)
| Dock/Modular Rack/AC Adapter: IPX1 (protected against harmful effects of vertically falling water drops) |
| Transport Dock: IP22 (protected against ingress of foreign objects no less than 12.5 mm and against access to hazardous parts with finger; protected against harmful effects of vertically falling water drops with the device tilted at any angle up to 15°) |
| Degree of safety of application in the presence of flammable anesthetic mixture with air or with oxygen or nitrous oxide | The equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide |
| Mode of operation | Continuous |

A.2 Physical Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Maximum Weight (kg)</th>
<th>W × H × D (mm)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1 main unit</td>
<td>0.95</td>
<td>148.5 × 103 × 81</td>
<td>without internal CO₂ module</td>
</tr>
<tr>
<td>N1 main unit</td>
<td>1.17</td>
<td>148.5 × 103 × 81</td>
<td>with internal CO₂ module</td>
</tr>
<tr>
<td>Modular Rack</td>
<td>0.60</td>
<td>165 × 130 × 168</td>
<td>/</td>
</tr>
<tr>
<td>Dock</td>
<td>0.97</td>
<td>190 × 125 × 155</td>
<td>/</td>
</tr>
<tr>
<td>Transport Dock</td>
<td>2.51</td>
<td>162.4 × 253 × 195.5</td>
<td>with cable box</td>
</tr>
<tr>
<td>Transport Dock</td>
<td>1.80</td>
<td>162.4 × 113 × 195.5</td>
<td>without cable box</td>
</tr>
<tr>
<td>Microstream CO₂ module</td>
<td>0.40</td>
<td>136.5 × 40 × 102</td>
<td>/</td>
</tr>
<tr>
<td>Sidestream CO₂ module</td>
<td>0.64</td>
<td>136.5 × 40 × 102</td>
<td>with O₂</td>
</tr>
<tr>
<td>Sidestream CO₂ module</td>
<td>0.52</td>
<td>136.5 × 40 × 102</td>
<td>without O₂</td>
</tr>
</tbody>
</table>
### A.3 Environmental Specifications

**WARNING**

- The monitor may not meet the performance specifications if stored or used outside the specified temperature and humidity ranges. If the performance of the equipment is degraded due to aging or environmental conditions, contact your service personnel.
- When the monitor and related products have differing environmental specifications, the effective range for the combined products is that range which is common to the specifications for all products.
- The monitor cannot be transported in the temperature lower than -30°C.

**NOTE**

- The environmental specification of unspecified parameter modules are the same as those of the main unit.

<table>
<thead>
<tr>
<th>Components</th>
<th>Property (unit)</th>
<th>Operating Condition</th>
<th>Storage Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Unit/Transport Dock/AC Adapter</td>
<td>Temperature (°C)</td>
<td>0 to 40</td>
<td>-30 to 70</td>
</tr>
<tr>
<td></td>
<td>Relative humidity (noncondensing) (%)</td>
<td>5 to 95</td>
<td>5 to 95</td>
</tr>
<tr>
<td></td>
<td>Barometric (mmHg)</td>
<td>427.5 to 805.5</td>
<td>375 to 805.5 (with CO₂)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>120 to 805.5 (without CO₂)</td>
</tr>
<tr>
<td>Modular Rack/Dock</td>
<td>Temperature (°C)</td>
<td>0 to 40</td>
<td>-20 to 60</td>
</tr>
<tr>
<td></td>
<td>Relative humidity (noncondensing) (%)</td>
<td>15 to 95</td>
<td>10 to 95</td>
</tr>
<tr>
<td></td>
<td>Barometric (mmHg)</td>
<td>427.5 to 805.5</td>
<td>120 to 805.5</td>
</tr>
<tr>
<td>Microstream CO₂ module</td>
<td>Temperature (°C)</td>
<td>0 to 40</td>
<td>-20 to 60</td>
</tr>
<tr>
<td></td>
<td>Relative humidity (noncondensing) (%)</td>
<td>15 to 95</td>
<td>10 to 95</td>
</tr>
<tr>
<td></td>
<td>Barometric (mmHg)</td>
<td>430 to 790</td>
<td>430 to 790</td>
</tr>
<tr>
<td>Sidestream CO₂ module</td>
<td>Temperature (°C)</td>
<td>5 to 40</td>
<td>-20 to 60</td>
</tr>
<tr>
<td></td>
<td>Relative humidity (noncondensing) (%)</td>
<td>15 to 95</td>
<td>10 to 95</td>
</tr>
<tr>
<td></td>
<td>Barometric (mmHg)</td>
<td>430 to 790</td>
<td>375 to 805.5</td>
</tr>
</tbody>
</table>

**Transient operating conditions**

The monitor is operated in normal use for a period not less than 20 minutes when moved from room temperature (20°C ± 2°C) to an environment of a temperature range from -20°C to 50°C, and relative humidity range from 15% to 95% (non-condensing).

The monitor is operated in normal use for a period not less than 20 minutes when moved from storage temperature (range from -30°C to 70°C) to room temperature (20°C ± 2°C), and started up within 10 minutes after the movement.
A.4 Power Supply Specifications

A.4.1 External Power Supply Specifications

<table>
<thead>
<tr>
<th>N1 main unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
</tr>
<tr>
<td>Input current</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AC Adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
</tr>
<tr>
<td>Output</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
</tr>
<tr>
<td>Input current</td>
</tr>
<tr>
<td>Frequency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transport Dock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
</tr>
<tr>
<td>AC waveform: sine</td>
</tr>
<tr>
<td>Output</td>
</tr>
</tbody>
</table>

A.4.2 Battery Specifications

| Battery type | Rechargeable lithium-Ion battery |
|--------------|
| Voltage | 7.56 VDC |
| Capacity | 2500 mAh |

Run time

At least 8 hours when the monitor without internal CO₂ module is powered by two new fully-charged batteries at 25°C ± 5°C with factory default screen brightness, Wi-Fi disabled, ECG and SpO₂ cable connected, and auto NIBP measurements at an interval of 15 minutes.

At least 3 hours when the monitor with internal CO₂ module is powered by one new fully-charged battery at 25°C ± 5°C with factory default screen brightness, Wi-Fi enabled, CO₂ sampling line connected, Temp, IBP, ECG and SpO₂ cable connected, and auto NIBP measurements at an interval of 15 minutes.

Shutdown delay: at least 15 minutes after the low battery alarm first occurs.

Charge time

For the monitor without internal CO₂ module:
no more than 6 hours to 90% when the monitor is off.
no more than 10 hours to 90% when the monitor is on.

For the monitor with internal CO₂ module:
no more than 3 hours to 90% when the monitor is off.
no more than 5 hours to 90% when the monitor is on.
A.5 Display Specifications

<table>
<thead>
<tr>
<th>N1 main unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen type</td>
</tr>
<tr>
<td>Screen Size (diagonal)</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
<tr>
<td>Pixel per inch (PPI)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen type</td>
</tr>
<tr>
<td>Screen Size (diagonal)</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
</tbody>
</table>

A.6 Touchscreen Specifications

| Screen type | Capacitive, multi-point touch |

A.7 LEDs

A.7.1 Main Unit

| Alarm lamp | 1 (three color-coded: red, yellow, and cyan) |
| Power-on LED | 1 (green) |
| External power LED | 1 (green) |
| Battery LED | 1 (two color-coded: yellow and green) |

A.7.2 Dock

| Connection status LED | 1 (green) |
| External power supply LED | 1 (green) |

A.7.3 Transport Dock

| Power-on LED | 1 (green) |

A.7.4 AC Adapter

| Power-on LED | 1 (green) |
A.8 Audio Indicator

| Speaker | Give alarm tones (45 to 85 dB), reminder tones, key tones, QRS tones; support PITCH TONE and multi-level tone modulation; alarm tones comply with IEC 60601-1-8. |

A.9 Monitor Interface Specifications

A.9.1 Interface Specifications of the Main Unit

<table>
<thead>
<tr>
<th>DC power input connector</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multifunctional connector</td>
<td>1</td>
</tr>
<tr>
<td>Multi-pin connector</td>
<td>1</td>
</tr>
<tr>
<td>Communication interface</td>
<td>4</td>
</tr>
<tr>
<td>Infrared filter</td>
<td>1</td>
</tr>
<tr>
<td>Contact</td>
<td>2</td>
</tr>
<tr>
<td>Power switch</td>
<td>1</td>
</tr>
<tr>
<td>Sample line connector of the Sidestream CO₂</td>
<td>1</td>
</tr>
<tr>
<td>Gas outlet</td>
<td>1</td>
</tr>
<tr>
<td>ECG cable connector</td>
<td>1</td>
</tr>
<tr>
<td>SpO₂ sensor connector</td>
<td>1</td>
</tr>
<tr>
<td>NIBP cuff connector</td>
<td>1</td>
</tr>
<tr>
<td>IBP cable connector</td>
<td>1</td>
</tr>
<tr>
<td>Temperature probe connector</td>
<td>2</td>
</tr>
</tbody>
</table>

A.9.2 Interface Specifications of the Modular Rack

<table>
<thead>
<tr>
<th>Multi-pin connector</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrared filter</td>
<td>1</td>
</tr>
<tr>
<td>Pogo pin</td>
<td>3</td>
</tr>
<tr>
<td>Contact</td>
<td>2</td>
</tr>
</tbody>
</table>

A.9.3 Interface Specifications of the Dock

<table>
<thead>
<tr>
<th>Network connector</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipotential grounding terminal</td>
<td>1</td>
</tr>
<tr>
<td>AC power input connector</td>
<td>1</td>
</tr>
<tr>
<td>VGA connector</td>
<td>1</td>
</tr>
<tr>
<td>Host monitor connector</td>
<td>1</td>
</tr>
<tr>
<td>USB connector</td>
<td>2</td>
</tr>
<tr>
<td>Multi-pin connector</td>
<td>1</td>
</tr>
</tbody>
</table>
### A.10 Signal Outputs Specifications

#### ECG Analog Output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
</table>
| Bandwidth (-3dB; reference frequency: 10Hz) | Diagnostic mode: 0.05 to 150 Hz  
Monitor mode: 0.5 to 40 Hz  
Surgical mode: 1 to 20 Hz  
ST mode: 0.05 to 40 Hz |
| Maximum QRS delay                      | 25 ms (in diagnostic mode, and non-paced)                                  |
| Gain (reference frequency 10Hz)        | 1V/mV (±5%)                                                                |
| Pace enhancement                       | Signal amplitude: V_{oh}≥2.5V  
Pulse width: 10ms±5%  
Signal rising and falling time: ≤100μs |

#### IBP Analog Output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth (-3dB; reference frequency: 1Hz)</td>
<td>0 to 40 Hz</td>
</tr>
<tr>
<td>Maximum transmission delay</td>
<td>30 ms</td>
</tr>
<tr>
<td>Gain (reference frequency 1Hz)</td>
<td>1 V/100 mmHg, ±5%</td>
</tr>
</tbody>
</table>

#### Defib Sync Pulse

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output impedance</td>
<td>≤100 ohm</td>
</tr>
<tr>
<td>Maximum time delay</td>
<td>35 ms (R-wave peak to leading edge of pulse)</td>
</tr>
</tbody>
</table>
| Amplitude                              | High level: 3.5 to 5 V, ±5%, providing a maximum of 10 mA output current;  
Low level: < 0.5 V, receiving a maximum of 5 mA input current.             |
| Pulse width                            | 100 ms ±10%                                                                |
| maximum rising and falling time        | 1 ms                                                                       |

#### Video Output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video signals</td>
<td>VGA signal</td>
</tr>
</tbody>
</table>

#### Alarm Output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm delay time from the monitor to remote equipment</td>
<td>The alarm delay time from the monitor to remote equipment is ≤2 seconds, measured at the monitor signal output connector.</td>
</tr>
<tr>
<td>Alarm signal sound pressure level range</td>
<td>45 db(A) to 85 db(A) within a range of one meter</td>
</tr>
</tbody>
</table>

### A.11 Data Storage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trends</td>
<td>A minimum of 120 hours trend data with the resolution no less than 1 minute.</td>
</tr>
<tr>
<td>Events</td>
<td>1000 events</td>
</tr>
<tr>
<td>NIBP measurements</td>
<td>1000 sets</td>
</tr>
<tr>
<td>Interpretation of resting 12-lead ECG results</td>
<td>20 sets</td>
</tr>
<tr>
<td>Full-disclosure waveforms</td>
<td>48 hours at maximum. The specific storage time depends on the waveforms stored and the number of stored waveforms.</td>
</tr>
<tr>
<td>OxyCRG view</td>
<td>48 hours. Trend data is stored one dot per second and the waveform stored is a compressed waveform.</td>
</tr>
</tbody>
</table>
A.12 Out-Of-Hospital Transport - Standards Compliance

- **Shock Tests** according to IEC TR 60721-4-7, Class 7M3. Test procedure according to IEC/EN60068-2-27 (peak acceleration up to 100g).
- **Random Vibration** according to IEC TR 60721-4-7, Class 7M3. Test procedure according to IEC/EN 60068-2-64 (RMS acceleration 5g).
- **Sinusoidal Vibration** according to IEC TR 60721-4-7, Class 7M3. Test procedure according to IEC/EN 60068-2-6 (acceleration up to amplitude 2g).
- **Bump Test** according to IEC/EN60068-2-29 (peak acceleration 15 g, 1000 bumps).
- **Free Fall Test** according to EN 60068-2-32 (height 1.2 m).
- **EN 1789:2007+A2:2014 Medical vehicles and their equipment - Road ambulances.**
- **EN 13718-1:2008 Medical vehicles and their equipment-Air ambulances-Part 1: Requirements for medical devices used in air ambulances.**
- **IEC 60601-1-12:2014 Medical electrical equipment -Part 1-12: General requirements for basic safety and essential performance -Collateral Standard: Requirements for medical electrical equipment and medical electrical systems intended for use in the emergency medical services environment.**
- **RTCA DO-160G** Environmental Conditions and Test Procedures for Airborne Equipment.
  - Section 7 Operational Shocks and Crash Safety
  - Section 8 Vibration (Category S for fixed wing and Category U2 for rotary wing)
- **MIL-STD-810G** Environmental engineering considerations and laboratory tests
  - Method 514.6 Category 13 - Fixed Wing Propeller Aircraft
  - Method 514.6 Category 14 Category 14 Helicopter, General, UH-60
  - Method 514.6 Category 20 - Ground vehicles - ground mobile
  - Method 514.6 Category 24 - Helicopter minimum integrity test
- **Extended radiated susceptibility tests**
  - TETRA 400: 27V/m
  - GMRS 460; FRS 460; GSM 800/900; TETRA 800; iDEN 820; CDMA 850; LTE Band 5; GSM 1800; CDMA 1900; GSM 1900; DECT; LTE Band 1, 3, 4, 25; UMTS; Bluetooth; WLAN; 802.11 b/g/n; RFID 2450; LTE Band 7: 28V/m
  - LTE Band 13, 17; WLAN 802.11 a/n: 9V/m
- **Magnetic Field emission** according to MIL STD 461F, Chapter RE101: Radiated emissions, magnetic field, 30Hz to 100KHz. Limit class: Army.
- **Magnetic Field susceptibility**: Radiated susceptibility, magnetic field, 50 and 60 Hz, 30 A/m.
### A.13 Wi-Fi Specifications

#### A.13.1 Wi-Fi Technical Specifications

<table>
<thead>
<tr>
<th>Protocol</th>
<th>IEEE 802.11a/b/g/n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation mode</td>
<td>DSSS and OFDM</td>
</tr>
<tr>
<td>Operating frequency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ETSI: 2.4 GHz to 2.483 GHz</td>
</tr>
<tr>
<td></td>
<td>FCC: 2.4 GHz to 2.483 GHz</td>
</tr>
<tr>
<td></td>
<td>MIC: 2.4 GHz to 2.495GHz</td>
</tr>
<tr>
<td></td>
<td>KC: 2.4 GHz to 2.483 GHz</td>
</tr>
<tr>
<td></td>
<td>ETSI: 5.15 GHz to 5.35 GHz, 5.47 GHz to 5.725 GHz</td>
</tr>
<tr>
<td></td>
<td>FCC: 5.15 GHz to 5.35 GHz, 5.725 GHz to 5.82 GHz</td>
</tr>
<tr>
<td></td>
<td>MIC: 5.15GHz to 5.35 GHz</td>
</tr>
<tr>
<td></td>
<td>KC: 5.15 GHz to 5.35 GHz, 5.47 GHz to 5.725 GHz, 5.725 GHz to 5.82 GHz</td>
</tr>
<tr>
<td>Channel spacing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11b/g: 5 MHz</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11n (at 2.4 GHz): 5 MHz</td>
</tr>
<tr>
<td></td>
<td>IEEE802.11a: 20 MHz</td>
</tr>
<tr>
<td></td>
<td>IEEE802.11n (at 5 GHz): 20 MHz</td>
</tr>
<tr>
<td>Wireless data rate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11b: 1 Mbps to 11 Mbps</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11g: 6 Mbps to 54 Mbps</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11n: 6.5 Mbps to 72.2 Mbps</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.11a: 6 Mbps to 54 Mbps</td>
</tr>
<tr>
<td>Output power</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;20 dBm (CE requirements, detection mode: RMS)</td>
</tr>
<tr>
<td></td>
<td>&lt;30 dBm (FCC requirements, detection mode: peak power)</td>
</tr>
<tr>
<td>Operating mode</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Data security</td>
<td>Standards: WPA-PSK, WPA2-PSK, WPA-Enterprise, WPA2-Enterprise</td>
</tr>
<tr>
<td></td>
<td>EAP method: EAP-FAST, EAP-TLS, EAP-TTLS, PEAP-GTC, PEAP-MSCHAPv2, PEAP-TLS, LEAP</td>
</tr>
<tr>
<td></td>
<td>Encryption: AES</td>
</tr>
</tbody>
</table>

#### A.13.2 Wi-Fi Performance Specifications

**WARNING**

- All network functions of data communication are designed to operate on a private network.

---

#### A.13.2.1 System Capacity

Number of the monitors supported by a single AP: ≤ 16.

Testing conditions are as follows:

- Each monitor can communicate with the CMS.
- Two monitors are used to view other monitors.
- Only one monitor can transmit history data.
- The weakest strength of the AP signal where the monitor is located cannot be less than -65 dBm.

#### A.13.2.2 Resistance to Wireless Interference

The distance between the interfering devices and the monitor is greater than 20 cm. A Wi-Fi interference (no greater than -85 dBm) in the same channel and a Wi-Fi interference (no greater than -50 dBm) in an adjacent-channel are presented synchronously. The interfering devices include, but are not limited to, 2.4 GHz wireless devices, cellular mobile networks, microwave ovens, intercoms, cordless phones, and ESU equipment. The interfering devices do not include Wi-Fi devices. The monitoring network must support the following requirements:

- The total delay of data transmission from the monitor to the CMS: ≤ 2 seconds.
The delay for monitor-related settings configured at the CMS to be effective: ≤ 2 seconds.

The total delay of data transmission from one monitor to the other: ≤ 2 seconds.

The delay for the monitor to reset alarms of another to be effective: ≤ 2 seconds.

**A.13.2.3 Wi-Fi Network Stability**

The ratio of the communication data loss on the CMS from any monitor does not exceed 0.1% over a 24-hour period (12 of the 16 monitors connected to the network roam for 30 times).

Testing conditions are as follows:

- Number of the monitors supported by a single AP: ≤ 16.
- Each monitor can communicate with the CMS.
- Two monitors are used to view other monitors.
- Only one monitor can transmit history data.
- The weakest strength of the AP signal where the monitor is located cannot be less than -65 dBm.

**A.13.2.4 Line of Sight Distance**

The line of sight distance between the monitor and the AP is no less than 50 meters.

**A.14 Measurement Specifications**

The adjustable range of alarm limits is the same with the measurement range of signals unless otherwise specified.

**A.14.1 ECG Specifications**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead set 3-lead: I, II, III 5-lead: I, II, III, aVR, aVL, aVF, V 6-lead: I, II, III, aVR, aVL, aVF, Va, Vb 12-lead: I, II, III, aVR, aVL, aVF, V1 to V6</td>
<td></td>
</tr>
<tr>
<td>ECG standard AHA, IEC</td>
<td></td>
</tr>
<tr>
<td>Display sensitivity 1.25 mm/mV (X0.125), 2.5 mm/mV (X0.25), 5 mm/mV (X0.5), 10 mm/mV (X1), 20 mm/mV (X2), 40 mm/mV (X4), Auto, less than ±5% error</td>
<td></td>
</tr>
<tr>
<td>Sweep speed 6.25 mm/s, 12.5 mm/s, 25 mm/s, 50 mm/s, less than ±5% error</td>
<td></td>
</tr>
<tr>
<td>Bandwidth (-3dB) Diagnostic mode: 0.05 to 150 Hz Monitor mode: 0.5 to 40 Hz Surgery mode: 1 to 20 Hz ST mode: 0.05 to 40 Hz High Freq Cut-off (for 12-lead ECG analysis): 350 Hz (0.05 to 350 Hz), 150 Hz (0.05 to 150 Hz), 35 Hz (0.05 to 35 Hz), 20 Hz (0.05 to 20 Hz) selectable.</td>
<td></td>
</tr>
<tr>
<td>Common mode rejection ratio Diagnostic mode, monitor mode, surgery mode, ST mode, High Freq Cut-off: &gt;90 dB (with notch filter off) Monitor mode, surgery mode, ST mode: &gt;105 dB (with notch filter on)</td>
<td></td>
</tr>
<tr>
<td>Notch filter 50/60 Hz Monitor, surgical, and ST mode: notch filter turns on automatically Diagnostic mode and High Freq Cut-off: notch filter is turned on/off manually</td>
<td></td>
</tr>
<tr>
<td>Differential input impedance ≥5 MO</td>
<td></td>
</tr>
<tr>
<td>Input signal range ±8 mV (peak-to-peak value)</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Specification</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Electrode offset potential tolerance</td>
<td>±500 mV</td>
</tr>
</tbody>
</table>
| Lead-off detection current               | Measuring electrode: <0.1 μA  
Drive electrode: <1 μA                                                              |
| Input offset current                     | ≤0.1 μA, (drive lead≤1 μA)                                                    |
| Defibrillation protection                | Withstands 5000V (360 J) charge without data loss or corruption  
Baseline recovery time: <5 s  
Polarization recovery time: <10 s  
Defibrillation energy absorption: ≤10% (100 Ω load) |
| Patient leakage current                  | <10 uA                                                                       |
| Calibration signal                       | 1 mV (peak-to-peak value) ±5%                                                   |
| ESU protection                           | Cut mode: 300 W  
Coagulate mode: 100 W  
Recovery time: ≤10 s  
In compliance with the requirements in clause 202.6.2.101 of IEC 60601-2-27: 2011 |
| Pace Pulse                               | Pace pulses meeting the following conditions are labeled with a PACE marker:  
Amplitude: ±2 mV to ±700 mV  
Width: 0.1 ms to 2 ms  
Rise time: 10 μs to 100 μs (< 10% of pulse width)  
No overshoot |
| Pace pulse rejection                     | When tested in accordance with the IEC 60601-2-27: 2011: 201.12.1.101.13, the heart rate meter rejects all pulses meeting the following conditions.  
Amplitude: ±2 mV to ±700 mV  
Width: 0.1 ms to 2 ms  
Rise time: 10 μs to 100 μs (< 10% of pulse width)  
No overshoot |
| HR                                       | Neonate: 15 to 350 bpm  
Pediatric: 15 to 350 bpm  
Adult: 15 to 300 bpm  
Resolution: 1 bpm  
Accuracy: ±1 bpm or ±1%, whichever is greater.  
Sensitivity: 200 μV (lead II)  
Minimum QRS detection threshold:  
Adult and pediatric: 0.16 – 0.48 mV  
Neonate: 0.12 – 0.40 mV  
HR averaging method: In compliance with the requirements in Clause 201.7.9.2.9.101 b) 3) of IEC 60601-2-27: 2011, the following method is used:  
If the last 3 consecutive RR intervals are greater than 1200 ms, the 4 most recent RR intervals are averaged to compute the HR. Otherwise, heart rate is computed by subtracting the maximum and minimum ones from the most recent 12 RR intervals and then averaging the remaining 10 RR intervals.  
The HR value displayed on the monitor screen is updated no more than one second. |
| Response to irregular rhythm | In compliance with the requirements in Clause 201.7.9.2.9.101 b) 4) of IEC 60601-2-27: 2011, the heart rates for the specified test signals after 20 seconds of stabilization are:  
Ventricular bigeminy (waveform A1): 80±1 bpm  
Slow alternating ventricular bigeminy (waveform A2): 60±1 bpm  
Rapid alternating ventricular bigeminy (waveform A3): 120±1 bpm  
Bidirectional systoles (waveform A4): 90±2 bpm |
|---|
| Response time to heart rate change | Meets the requirements of IEC 60601-2-27: 2011: Clause 201.7.9.2.9.101 b) 5).  
From 80 to 120 bpm: less than 11 s  
From 80 to 40 bpm: less than 11 s |
| Time to alarm for tachycardia | Meets the requirements in Clause 201.7.9.2.9.101 b) 6) of IEC 60601-2-27: 2011.  
Waveform  
B1h-range: < 11 s  
B1-range: < 11 s  
B1d-range: < 11 s  
B2h-range: < 11 s  
B2-range: < 11 s  
B2d-range: < 11 s |
| Tall T-wave rejection capability | When the test is performed based on Clause 201.12.1.101.17 of IEC 60601-2-27: 2011, the heart rate calculation is not affected for QRS of 1 mV amplitude and 100 ms duration, T-wave duration of 180 ms and amplitude lower than 1.2 mV, and QT interval of 350 ms. |
| Arrhythmia Analysis Classifications | Asystole, V-Fib/V-Tach, V-Tach, Vent Brady, Extreme Tachy, Extreme Brady, Vent Rhythm, PVCs/min, Pauses/min, Couple, Bigeminy, Trigeminy, R on T, Run PVCs, PVC, Tachy, Brady, Missed Beat, Pacer Not Pacing, Pacer Not Capture, Multiform PVC, Nonsus V-Tach, Pause, Irr Rhythm, A-Fib |
| ST Segment Analysis | Measurement range -2.0 mV to 2.0 mV RTI  
Accuracy -0.8 mV to 0.8 mV: ±0.02 mV or ±10%, whichever is greater. Beyond this range: Not specified.  
Refreshing rate 10 s  
Resolution 0.01 mV |
| QT/QTc Analysis | Measurement range QT: 200 to 800 ms  
QTc: 200 to 800 ms  
QT-HR: 15 bpm to 150 bpm for adult, 15 bpm to 180 bpm for pediatric and neonate  
Accuracy QT: ±30 ms  
Resolution QT: 4 ms  
QTc: 1 ms |
| 12-lead ECG Interpretation | Sampling rate 1000 samples/s (waveform)  
500 samples/s (algorithm)  
Amplitude quantisation 24 bits |
| Alarm limit | Range | Step |
### A.14.2 Resp Specifications

| HR High | HR≤40 bpm: (low limit + 2 bpm) to 40 bpm  
| HR > 40 bpm: (low limit + 5 bpm) to 295 bpm (Adult/Pediatric)  
| (low limit + 5 bpm) to 300 bpm (Neonate) | HR≤40 bpm: 1 bpm  
| HR > 40 bpm: 5 bpm |
| HR Low | HR≤40 bpm: 16 bpm to (HR high - 2 bpm)(Adult/Pediatric)  
| 15 bpm to (HR high - 2 bpm) (Neonate)  
| HR > 40 bpm: 40 bpm to (HR high - 5 bpm) |
| ST High | (low limit + 0.2 mV) to 2.0 mV (ST alarm mode: Absolute)  
| 0 mV to 2.0 mV (ST alarm mode: Relative) |
| ST Low | -2.0 mV to (high limit - 0.2 mV) (ST alarm mode: Absolute)  
| -2.0 mV to 0 mV (ST alarm mode: Relative) |
| QTc High | 200 ms to 800 ms |
| ΔQTc High | 30 ms to 200 ms |

### A.14.3 SpO2 Specifications

Refer to Appendix E SpO2 Sensor Accuracy for the clinical study results of SpO2 sensor accuracy.

<table>
<thead>
<tr>
<th>Alarm limit</th>
<th>Range (%)</th>
<th>Step (%)</th>
</tr>
</thead>
</table>
| RR High     | Adult, pediatric:  
| RR≤20       | (low limit + 2) to 20 |
| RR>20       | (low limit + 5) to 100  
| Neonate:    | RR≤20       | (low limit + 2) to 20 |
| RR>20       | (low limit + 5) to 150  
| RR Low      | RR≤20       | 0 to (high limit - 2)  
| RR>20       | 20 to (high limit - 5)  

#### Technique
- Trans-thoracic impedance

#### Lead
- Options are lead I, II, and Auto.

#### Respiration excitation waveform
- <300 μA RMS, 62.8 kHz (±10%)

#### Minimum respiration impedance threshold
- 0.3Ω

#### Baseline impedance range
- 200 to 2500Ω (using an ECG cable with 1kΩ resistance)

#### Bandwidth
- 0.2 to 2.5 Hz (-3 dB)

#### Sweep speed
- 3mm/s, 6.25 mm/s, 12.5 mm/s, 25 mm/s or 50 mm/s, less than 10% error

#### Respiration Rate

| Measurement range | Adult: 0 to 120 rpm  
| Pediatric, neonate: 0 to 150 rpm |
| Resolution        | 1 rpm  
| Accuracy          | 7 to 150 rpm: ±2 rpm or ±2%, whichever is greater  
|                 | 0 to 6 rpm: not specified  
| Zero RR alarm delay | 10 s, 15 s, 20 s, 25 s, 30 s, 35 s, 40 s  
| Alarm limit       | Range (rpm)  
| RR High           | Adult, pediatric:  
| RR≤20             | (low limit + 2) to 20  
| RR>20             | (low limit + 5) to 100 |
| RR Low            | RR≤20       | 0 to (high limit - 2)  
| RR>20             | 20 to (high limit - 5)  

| RR≤20: 1  
| RR>20: 5  

#### Alarm limit

<table>
<thead>
<tr>
<th>Alarm limit</th>
<th>Range (%)</th>
</tr>
</thead>
</table>
| RR Low      | RR≤20       | 0 to (high limit - 2)  
| RR>20       | 20 to (high limit - 5)  

#### A.14.3 SpO2 Specifications

Refer to Appendix E SpO2 Sensor Accuracy for the clinical study results of SpO2 sensor accuracy.
<table>
<thead>
<tr>
<th>SpO2 High</th>
<th>(low limit + 2) to 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO2 Low</td>
<td>Masimo: (Desat+1) to (high limit - 2)</td>
</tr>
<tr>
<td></td>
<td>Nellcor: (Desat+1) or 20 (whichever is greater) to (high limit - 2)</td>
</tr>
<tr>
<td>Desat</td>
<td>0 to (low limit - 1)</td>
</tr>
</tbody>
</table>

**Masimo SpO2 Module**

<table>
<thead>
<tr>
<th>Standards</th>
<th>Meets the requirements of ISO 80601-2-61: 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>1 to 100%</td>
</tr>
<tr>
<td>Resolution</td>
<td>1%</td>
</tr>
<tr>
<td>Response time</td>
<td>≤ 20 s (normal perfusion, no disturbance, SpO2 value sudden change from 70% to 100%)</td>
</tr>
<tr>
<td>Accuracy(^1)</td>
<td>70 to 100%: ±2% (adult/pediatric, without motion)</td>
</tr>
<tr>
<td></td>
<td>70 to 100%: ±3% (adult/pediatric, with motion)</td>
</tr>
<tr>
<td></td>
<td>70 to 100%: ±3% (neonate)</td>
</tr>
<tr>
<td></td>
<td>1% to 69%: Not specified.</td>
</tr>
<tr>
<td>Refresh rate</td>
<td>≤ 1 s</td>
</tr>
<tr>
<td>SpO2 averaging time</td>
<td>2-4 s, 4-6 s, 8 s, 10 s, 12 s, 14 s, 16 s</td>
</tr>
<tr>
<td>Low perfusion conditions</td>
<td>Pulse amplitude: &gt;0.02%</td>
</tr>
<tr>
<td></td>
<td>Light penetration: &gt;5%</td>
</tr>
<tr>
<td>Low perfusion SpO2 accuracy(^2)</td>
<td>±2%</td>
</tr>
<tr>
<td>PI measurement range</td>
<td>0.02 to 20%</td>
</tr>
</tbody>
</table>

\(^1\) The Masimo pulse oximeter with sensors have been validated for no motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies in the range of 70% to 100% SpO2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population. One percent was added to the accuracies for neonatal sensors to account for accuracy variation due to properties of fetal hemoglobin.

The Masimo pulse oximeter with sensors has been validated for motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions at 2 to 4 Hz. At an amplitude of 1 to 2 cm and non-repetitive motion between 1 to 5 Hz. At an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70% to 100% SpO2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

\(^2\) The Masimo pulse oximeter has been validated for low perfusion accuracy in bench top testing against a Biotek Index 2 simulator and Masimo’s simulator with signal strengths of greater than 0.02% and a % transmission of greater than 5% for saturations ranging from 70 to 100%. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

**Nellcor SpO2 Module**

| Measurement range          | 0 to 100%                                      |
| Resolution                 | 1%                                              |
| Refresh rate               | ≤ 1 s                                           |
| Response time              | ≤ 30 s (normal perfusion, no disturbance, SpO2 value sudden change from 70% to 100%) |
| Accuracy                   | 70 to 100%: ±2% (adult/pediatric)              |
|                           | 70 to 100%: ±3% (neonate)                      |
|                           | 0% to 69%: Not specified.                     |

When the SpO2 sensor is applied for neonatal patients as indicated, the specified accuracy range is increased by ±1%, to compensate for the theoretical effect on oximeter measurements of fetal hemoglobin in neonatal blood.
### A.14.4 PR Specifications

<table>
<thead>
<tr>
<th>Alarm limit</th>
<th>Range (bpm)</th>
<th>Step (bpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR High</td>
<td>PR ≤ 40: (low limit + 2) to 40&lt;br&gt;PR &gt; 40: (low limit + 5) to 295</td>
<td>PR ≤ 40: 1&lt;br&gt;PR &gt; 40: 5</td>
</tr>
<tr>
<td>PR Low</td>
<td>PR ≤ 40: 16 to (high limit - 2)&lt;br&gt;PR &gt; 40: 40 to (high limit - 5)</td>
<td></td>
</tr>
</tbody>
</table>

#### PR from Masimo SpO₂

| Measurement range | 25 to 240 bpm |
| Resolution        | 1 bpm         |
| Response time     | ≤ 20 s (with normal perfusion, no disturbance, and a PR value transition from 25 to 220 bpm) |
| Accuracy          | ± 3 bpm (without motion)<br>± 5 bpm (with motion) |
| Refresh rate      | ≤ 1 s         |

#### PR from Nellcor SpO₂

| Measurement range | 20 to 300 bpm |
| Resolution        | 1 bpm         |
| Response time     | ≤ 30 s (with normal perfusion, no disturbance, and a PR value transition from 25 to 250 bpm) |
| Accuracy          | 20 to 250 bpm: ± 3 bpm<br>251 to 300 bpm, not specified |
| Refresh rate      | ≤ 1 s         |

#### PR from NIBP

| Measurement range | 30 to 300 bpm |
| Resolution        | 1 bpm         |
| Accuracy          | ± 3 bpm or ±3%, whichever is greater |

#### PR from IBP

| Measurement range | 25 to 350 bpm |
| Resolution        | 1 bpm         |
| Accuracy          | ± 1 bpm or ±1%, whichever is greater |
### A.14.5 Temp Specifications

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Meets the requirements of ISO 80601-2-56: 2009</td>
</tr>
<tr>
<td>Technique</td>
<td>Thermal resistance</td>
</tr>
<tr>
<td>Operating mode</td>
<td>Direct mode</td>
</tr>
<tr>
<td>Measurement range</td>
<td>0 to 50 °C (32 to 122 °F)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1°C</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1 °C or ±0.2 °F (excluding probe error)</td>
</tr>
<tr>
<td>Refreshing rate</td>
<td>≤1 s</td>
</tr>
<tr>
<td>Minimum time for accurate measurement</td>
<td>Body surface: &lt;100 s</td>
</tr>
<tr>
<td></td>
<td>Body cavity: &lt;80 s</td>
</tr>
<tr>
<td><strong>Alarm limit</strong></td>
<td><strong>Range</strong></td>
</tr>
<tr>
<td>T1/T2 High</td>
<td>(low limit +1.0) to 50.0 °C</td>
</tr>
<tr>
<td></td>
<td>(low limit +2.0) to 122.0 °F</td>
</tr>
<tr>
<td>T1/T2 Low</td>
<td>0.1 to (high limit - 1.0) °C</td>
</tr>
<tr>
<td></td>
<td>32.2 to (high limit - 2.0) °F</td>
</tr>
<tr>
<td>ΔT High</td>
<td>0.1 to 50.0 °C</td>
</tr>
<tr>
<td></td>
<td>0.2 to 90.0 °F</td>
</tr>
</tbody>
</table>

### A.14.6 NIBP Specifications

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Meets the requirements of IEC 80601-2-30: 2013</td>
</tr>
<tr>
<td>Technique</td>
<td>Oscillometry</td>
</tr>
<tr>
<td>Mode of operation</td>
<td>Manual, Auto, STAT, Sequence</td>
</tr>
<tr>
<td>Auto mode repetition intervals</td>
<td>1, 2, 2.5, 3, 5, 10, 15, 20, 30, 60, 90, 120, 180, 240 or 480 min</td>
</tr>
<tr>
<td>STAT mode cycle time</td>
<td>5 min</td>
</tr>
<tr>
<td>Max measurement time</td>
<td>Adult, pediatric: 180 s</td>
</tr>
<tr>
<td></td>
<td>Neonate: 90 s</td>
</tr>
<tr>
<td>Heart rate range</td>
<td>30 to 300 bpm</td>
</tr>
<tr>
<td>Measurement ranges (mmHg)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adult</td>
</tr>
<tr>
<td>Systolic:</td>
<td>25 to 290</td>
</tr>
<tr>
<td>Diastolic:</td>
<td>10 to 250</td>
</tr>
<tr>
<td>Mean:</td>
<td>15 to 260</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Max mean error: ±5 mmHg</td>
</tr>
<tr>
<td></td>
<td>Max standard deviation: 8 mmHg</td>
</tr>
<tr>
<td>Resolution</td>
<td>1mmHg</td>
</tr>
<tr>
<td>Initial cuff inflation pressure range (mmHg)</td>
<td>Adult: 80 to 280</td>
</tr>
<tr>
<td></td>
<td>Pediatric: 80 to 210</td>
</tr>
<tr>
<td></td>
<td>Neonate: 60 to 140</td>
</tr>
<tr>
<td>Default initial cuff inflation pressure (mmHg)</td>
<td>Adult: 160</td>
</tr>
<tr>
<td></td>
<td>Pediatric: 140</td>
</tr>
<tr>
<td></td>
<td>Neonate: 90</td>
</tr>
<tr>
<td>Software overpressure protection</td>
<td>Adult: 297±3 mmHg</td>
</tr>
<tr>
<td></td>
<td>Pediatric: 297±3 mmHg</td>
</tr>
<tr>
<td></td>
<td>Neonate: 147±3 mmHg</td>
</tr>
</tbody>
</table>
### Measurement accuracy verification

In adult and pediatric modes, the blood pressure measurements measured with this device are in compliance with the Standard for Non-invasive sphygmomanometers (ISO 81060-2:2013) in terms of mean error and standard deviation by comparing with intra-arterial or auscultatory measurements (depending on the configuration) in a typical patient population. For auscultatory reference, the 5th Korotkoff sound was used to determine the diastolic pressure.

In neonatal mode, the blood pressure measurements measured with this device are in compliance with the American National Standard for Non-invasive sphygmomanometers (ISO 81060-2) in terms of mean error and standard deviation by comparing with intra-arterial measurements (depending on the configuration) in a typical patient population.

### A.14.7 IBP Specifications

| **Static pressure measurement range** | 0 mmHg to 300 mmHg |
| **Static pressure measurement accuracy** | ±3 mmHg |

<table>
<thead>
<tr>
<th><strong>Alarm limit</strong></th>
<th><strong>Range (mmHg)</strong></th>
<th><strong>Step (mmHg)</strong></th>
</tr>
</thead>
</table>
| NIBP-S High    | Adult: (low limit + 5) to 285  
                 Pediatric: (low limit + 5) to 235  
                 Neonate: (low limit + 5) to 135 | NIBP ≤ 50: 1  
                                               NIBP > 50: 5 |
| NIBP-S Low     | 26 to (high limit - 5) |              |
| NIBP-M High    | Adult: (low limit + 5) to 255  
                 Pediatric: (low limit + 5) to 210  
                 Neonate: (low limit + 5) to 120 |              |
| NIBP-M Low     | 16 to (high limit - 5) |              |
| NIBP-D High    | Adult: (low limit + 5) to 245  
                 Pediatric: (low limit + 5) to 195  
                 Neonate: (low limit + 5) to 110 |              |
| NIBP-D Low     | 11 to (high limit - 5) |              |
| NIBP-S Extreme High | Adult: (NIBP-S high limit + 5) to 290  
                               Pediatric: (NIBP-S high limit + 5) to 240  
                               Neonate: (NIBP-S high limit + 5) to 140 | NIBP ≤ 50: 1  
                                               NIBP > 50: 5 |
| NIBP-S Extreme Low | 25 to (NIBP-S low limit - 5) |              |
| NIBP-M Extreme High | Adult: (NIBP-M high limit + 5) to 260  
                               Pediatric: (NIBP-M high limit + 5) to 215  
                               Neonate: (NIBP-M high limit + 5) to 125 |              |
| NIBP-M Extreme Low | 15 to (NIBP-M low limit - 5) |              |
| NIBP-D Extreme High | Adult: (NIBP-D high limit + 5) to 250  
                               Pediatric: (NIBP-D high limit + 5) to 200  
                               Neonate: (NIBP-D high limit + 5) to 115 |              |
| NIBP-D Extreme Low | 10 to (NIBP-D low limit - 5) |              |

*Measurement accuracy verification: In adult and pediatric modes, the blood pressure measurements measured with this device are in compliance with the Standard for Non-invasive sphygmomanometers (ISO 81060-2:2013) in terms of mean error and standard deviation by comparing with intra-arterial or auscultatory measurements (depending on the configuration) in a typical patient population. For auscultatory reference, the 5th Korotkoff sound was used to determine the diastolic pressure.

In neonatal mode, the blood pressure measurements measured with this device are in compliance with the American National Standard for Non-invasive sphygmomanometers (ISO 81060-2) in terms of mean error and standard deviation by comparing with intra-arterial measurements (depending on the configuration) in a typical patient population.

### A.14.7 IBP Specifications

| **Standard** | Meets the requirements of IEC 60601-2-34: 2011. |
| **Technique** | Direct invasive measurement |

| **IBP** | |
| **Measurement range** | -50 to 300 mmHg |
| **Resolution** | 1 mmHg |
| **Accuracy** | ±2% or ±1 mmHg, whichever is greater (excluding sensor error) |
| **Refresh rate** | ≤1s |
## PPV

| Measurement range | 0% ~ 50% |

## Pressure transducer

| Excitement voltage | 5 VDC, ±2% |
| Sensitivity | 5 μV/V/mmHg |
| Zero adjustment range | ±200 mmHg |
| Impedance range | 300 to 3000Ω |
| Volume displacement | <0.04 mm³/100 mmHg |

## Alarm limit

<table>
<thead>
<tr>
<th></th>
<th>Range (mmHg)</th>
<th>Step (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sys High</td>
<td>IBP ≤ 50: (low limit + 2) to 50</td>
<td>IBP ≤ 50: 1</td>
</tr>
<tr>
<td>Mean High</td>
<td>IBP &gt; 50: (low limit + 5) to 295</td>
<td>IBP &gt; 50: 5</td>
</tr>
<tr>
<td>Dia High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sys Low</td>
<td>IBP ≤ 50: -49 to (high limit - 2)</td>
<td>IBP ≤ 50: 1</td>
</tr>
<tr>
<td>Mean Low</td>
<td>IBP &gt; 50: 50 to (high limit - 5)</td>
<td>IBP &gt; 50: 5</td>
</tr>
<tr>
<td>Dia Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art-S Extreme High</td>
<td>(High limit +5) to 300</td>
<td>IBP ≤ 50: 1</td>
</tr>
<tr>
<td>Art-M Extreme High</td>
<td></td>
<td>IBP &gt; 50: 5</td>
</tr>
<tr>
<td>Art-D Extreme High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art-S Extreme Low</td>
<td>-50 to (low limit -5)</td>
<td></td>
</tr>
<tr>
<td>Art-M Extreme Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art-D Extreme Low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## A.14.8 CO₂ Specifications

| Measurement mode | Sidestream, microstream |
| Technique | Infrared absorption |
| Zero RR delay | 10 s, 15 s, 20 s, 25 s, 30 s, 35 s, 40 s |

<table>
<thead>
<tr>
<th>Alarm limit</th>
<th>Range</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>EtCO₂ High</td>
<td>(low limit + 2) to 99 mmHg</td>
<td>1 mmHg</td>
</tr>
<tr>
<td>EtCO₂ Low</td>
<td>1 to (high limit - 2) mmHg</td>
<td></td>
</tr>
<tr>
<td>FiCO₂ High</td>
<td>1 to 99 mmHg</td>
<td></td>
</tr>
<tr>
<td>EtO₂ High</td>
<td>(low limit + 2%) to 100%</td>
<td>1%</td>
</tr>
<tr>
<td>EtO₂ Low</td>
<td>0% to (high limit - 2)%</td>
<td></td>
</tr>
<tr>
<td>FiO₂ High</td>
<td>(low limit + 2%) to 100%</td>
<td></td>
</tr>
<tr>
<td>FiO₂ Low</td>
<td>18% to (high limit - 2)%</td>
<td></td>
</tr>
</tbody>
</table>

## Sidestream CO₂ Module

<p>| Standard | Meets the requirements of ISO 80601-2-55: 2011 |
| CO₂ Measurement range | 0 to 150 mmHg |</p>
<table>
<thead>
<tr>
<th>CO\textsubscript{2} absolute accuracy*</th>
<th>Full accuracy mode:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0 \leq \text{CO}_2) concentration (\leq 40) mmHg</td>
<td>(\pm 2) mmHg</td>
</tr>
<tr>
<td>(41) mmHg (\leq \text{CO}_2) concentration (\leq 76) mmHg</td>
<td>(\pm 5%) of reading</td>
</tr>
<tr>
<td>(77) mmHg (\leq \text{CO}_2) concentration (\leq 99) mmHg</td>
<td>(\pm 10%) of reading</td>
</tr>
<tr>
<td>(100) mmHg (\leq \text{CO}_2) concentration (\leq 150) mmHg</td>
<td>(\pm (3) mmHg + 8% of reading)</td>
</tr>
<tr>
<td>(&gt; 150) mmHg</td>
<td>Unspecified</td>
</tr>
<tr>
<td>ISO accuracy mode:</td>
<td>Add (\pm 2) mmHg to the full accuracy mode</td>
</tr>
</tbody>
</table>

Accuracy specifications are affected by the breath rate and I:E. The EtCO\textsubscript{2} accuracy is within specification for breath rate \(\leq 60\) rpm and I/E ratio \(\leq 1:1\), or breath rate \(\leq 30\) rpm and I/E ratio \(\leq 2:1\).

<table>
<thead>
<tr>
<th>CO\textsubscript{2} resolution</th>
<th>1 mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\text{O}_2) measurement range</td>
<td>0 to 100%</td>
</tr>
<tr>
<td>(\text{O}_2) absolute accuracy</td>
<td></td>
</tr>
<tr>
<td>(0 \leq \text{O}_2) concentration (\leq 25)%</td>
<td>(\pm 1)%</td>
</tr>
<tr>
<td>(25 \leq \text{O}_2) concentration (\leq 80)%</td>
<td>(\pm 2)%</td>
</tr>
<tr>
<td>(80 \leq \text{O}_2) concentration (\leq 100)%</td>
<td>(\pm 3)%</td>
</tr>
<tr>
<td>(\text{O}_2) resolution</td>
<td>1%</td>
</tr>
<tr>
<td>Accuracy drift</td>
<td>Meets the requirements for measurement accuracy within 6 hours</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample flowrate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Using internal CO\textsubscript{2} module:</td>
<td></td>
</tr>
<tr>
<td>Adult, pediatric, neonatal:</td>
<td>50 ml/min</td>
</tr>
<tr>
<td>Using external CO\textsubscript{2} module with (\text{O}_2) sensor:</td>
<td></td>
</tr>
<tr>
<td>Adult, pediatric:</td>
<td>120 ml/min</td>
</tr>
<tr>
<td>Neonatal:</td>
<td>90 ml/min</td>
</tr>
<tr>
<td>Using the CO\textsubscript{2} module without (\text{O}_2) sensor:</td>
<td></td>
</tr>
<tr>
<td>Adult, pediatric:</td>
<td>120 ml/min</td>
</tr>
<tr>
<td>Neonatal:</td>
<td>70 ml/min, 90 ml/min</td>
</tr>
<tr>
<td>Sample flowrate tolerance</td>
<td>(\pm 15)% or (\pm 15) ml/min, whichever is greater.</td>
</tr>
<tr>
<td>Start-up time</td>
<td>20s (typical), 90 s (maximum)</td>
</tr>
</tbody>
</table>
### Response time

<table>
<thead>
<tr>
<th>For CO₂ measurements (using external CO₂ module without O₂ sensor):</th>
<th>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
<td>≤5.0 s @ 70 ml/min</td>
</tr>
<tr>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
<td>≤4.5 s @ 90 ml/min</td>
</tr>
<tr>
<td>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</td>
<td>≤5.0 s @ 120 ml/min</td>
</tr>
<tr>
<td>For CO₂ measurements (using external CO₂ module with O₂ sensor):</td>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
</tr>
<tr>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
<td>≤4.5 s @ 90 ml/min</td>
</tr>
<tr>
<td>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</td>
<td>≤5.0 s @ 120 ml/min</td>
</tr>
<tr>
<td>For CO₂ measurements (using internal CO₂ module):</td>
<td>Measured with a standard Oridion sampling line:</td>
</tr>
<tr>
<td>Measured with a standard Oridion sampling line:</td>
<td>≤5.0 s @ 50 ml/min</td>
</tr>
<tr>
<td>Measured with a prolonged Oridion sampling line:</td>
<td>≤6.5 s @ 50 ml/min</td>
</tr>
<tr>
<td>For O₂ measurements:</td>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
</tr>
<tr>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
<td>≤4.5 s @ 90 ml/min</td>
</tr>
<tr>
<td>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</td>
<td>≤5.0 s @ 120 ml/min</td>
</tr>
</tbody>
</table>

### Rise time

<table>
<thead>
<tr>
<th>For CO₂ measurements (using external CO₂ module without O₂ sensor):</th>
<th>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
<td>≤250 ms @ 70 ml/min</td>
</tr>
<tr>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
<td>≤250 ms @ 90 ml/min</td>
</tr>
<tr>
<td>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</td>
<td>≤300 ms @ 120 ml/min</td>
</tr>
<tr>
<td>For CO₂ measurements (using external CO₂ module with O₂ sensor):</td>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
</tr>
<tr>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
<td>≤250 ms @ 90 ml/min</td>
</tr>
<tr>
<td>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</td>
<td>≤300 ms @ 120 ml/min</td>
</tr>
<tr>
<td>For CO₂ measurements (using internal CO₂ module):</td>
<td>Measured with a standard Oridion sampling line:</td>
</tr>
<tr>
<td>Measured with a standard Oridion sampling line:</td>
<td>≤250 ms @ 50 ml/min</td>
</tr>
<tr>
<td>Measured with a prolonged Oridion sampling line:</td>
<td>≤280 ms @ 50 ml/min</td>
</tr>
<tr>
<td>For O₂ measurements:</td>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
</tr>
<tr>
<td>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</td>
<td>≤800 ms @ 90 ml/min</td>
</tr>
<tr>
<td>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</td>
<td>≤750 ms @ 120 ml/min</td>
</tr>
</tbody>
</table>

### awRR measurement range

| 0 to 150 rpm |

### awRR measurement precision

| <60 rpm: ±1 rpm |
| 60 to 150 rpm: ±2 rpm |

### awRR resolution

| 1 rpm |

### Data sample rate

| 50 Hz |
## Effect of interference gases on CO₂ measurements

<table>
<thead>
<tr>
<th>Gas</th>
<th>Concentration (%)</th>
<th>Quantitative effect*</th>
</tr>
</thead>
<tbody>
<tr>
<td>N₂O</td>
<td>≤60</td>
<td>±1 mmHg</td>
</tr>
<tr>
<td>Hal</td>
<td>≤4</td>
<td></td>
</tr>
<tr>
<td>Sev</td>
<td>≤5</td>
<td></td>
</tr>
<tr>
<td>Iso</td>
<td>≤5</td>
<td></td>
</tr>
<tr>
<td>Enf</td>
<td>≤5</td>
<td></td>
</tr>
<tr>
<td>Des</td>
<td>≤15</td>
<td>±2 mmHg</td>
</tr>
</tbody>
</table>

*: means an extra error should be added in case of gas interference when CO₂ measurements are performed between 0 to 40 mmHg.

## Effect of interference gases on O₂ measurements

<table>
<thead>
<tr>
<th>Gas</th>
<th>Quantitative effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>± 0.2%</td>
</tr>
<tr>
<td>N₂O</td>
<td>± 0.2%</td>
</tr>
<tr>
<td>HAL, DES, SEV, ISO, ENF</td>
<td>± 1.0%</td>
</tr>
</tbody>
</table>

## Microstream CO₂ Module

<table>
<thead>
<tr>
<th>Standard</th>
<th>Meets the requirements of ISO 80601-2-55: 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ Measurement range</td>
<td>0 to 99 mmHg</td>
</tr>
<tr>
<td>Accuracy*</td>
<td>0 to 38 mmHg: ±2 mmHg 39 to 99 mmHg: ±5% of the reading (0.08% increased in error for every 1 mmHg if the reading is more than 38 mmHg)</td>
</tr>
<tr>
<td>Accuracy drift</td>
<td>Meets the requirements for measurement accuracy within 6 hours</td>
</tr>
</tbody>
</table>

*: Accuracy applies for respiration rate up to 80 rpm. For respiration rate above 80 rpm and EtCO₂ exceeding 18 mmHg, the accuracy is 4 mmHg or ±12% of the reading, whichever is greater. For respiration rate above 60 rpm, the above accuracy can be achieved by using the CapnoLine H Set for Infant/Neonatal. In the presence of interfering gases, the above accuracy is maintained to within 4%.

<table>
<thead>
<tr>
<th>Resolution</th>
<th>1 mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample flow rate</td>
<td>50 ml/min ± 15</td>
</tr>
<tr>
<td>Initialization time</td>
<td>180 s (maximum)</td>
</tr>
<tr>
<td>Response time</td>
<td>≤2.9 s</td>
</tr>
<tr>
<td></td>
<td>(The response time is the sum of the rise time and the delay time when using a FilterLine of standard length)</td>
</tr>
<tr>
<td></td>
<td>Rise time: &lt;190 ms@50 ml/min</td>
</tr>
<tr>
<td></td>
<td>Delay time: ≤2.7 s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>awRR measurement range</th>
<th>0 to 150 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>awRR measurement accuracy</td>
<td>0 to 70 rpm: ±1 rpm</td>
</tr>
<tr>
<td></td>
<td>71 to 120 rpm: ±2 rpm</td>
</tr>
<tr>
<td></td>
<td>121 to 150 rpm: ±3 rpm</td>
</tr>
<tr>
<td>awRR resolution</td>
<td>1 rpm</td>
</tr>
<tr>
<td>Data sample rate</td>
<td>40 Hz</td>
</tr>
</tbody>
</table>
**EMC and Radio Regulatory Compliance**

**B.1 EMC**

The device meets the requirements of IEC 60601-1-2: 2014.

**WARNING**

- Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this device could result in increased electromagnetic emissions or decreased electromagnetic immunity of this device and result in improper operation.
- Use of this device adjacent to or stacked with other device should be avoided because it could result in improper operation. If such use is necessary, this device and the other device should be observed to verify that they are operating normally.
- Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the this device, including cables specified by the manufacturer. Otherwise, degradation of the performance of this device could result.
- The non-ME EQUIPMENT (e.g. Information Technical Equipment (ITE)) that is a part of an ME SYSTEM may be disrupted by the electromagnetic interference of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the non-ME EQUIPMENT or shielding the location.
- This device is intended for use in professional healthcare facility environment only. If it is used in a special environment, such as a magnetic resonance imaging environment, the equipment/system may be disrupted by the operation of nearby equipment.

**Guidance and Declaration - Electromagnetic Emissions**

The device is intended for use in the electromagnetic environment specified below. The customer or the user of the device should assure that it is used in such an environment.

<table>
<thead>
<tr>
<th>Emission tests</th>
<th>Compliance</th>
<th>Electromagnetic environment - guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted and radiated RF EMISSIONS</td>
<td>Group 1</td>
<td>The device uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic device.</td>
</tr>
<tr>
<td>Class B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conducted and radiated RF EMISSIONS</td>
<td>Class A</td>
<td>The device is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.</td>
</tr>
<tr>
<td>Class A (Used with Dock)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conducted and radiated RF EMISSIONS</td>
<td>Class A</td>
<td>The device is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.</td>
</tr>
<tr>
<td>Harmonic distortion IEC 61000-3-2: 2014</td>
<td>Class A</td>
<td>The device is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.</td>
</tr>
<tr>
<td>Voltage fluctuations and flicker</td>
<td>Complies</td>
<td></td>
</tr>
<tr>
<td>IEC 61000-3-3: 2013</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**

- The device needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.
• Other devices may affect this device even though they meet the requirements of CISPR.
• When an input signal is below the minimum amplitude provided in technical specifications, erroneous measurements could result.
• The EMISSIONS characteristics of this device make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this device might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the device.
• If the essential performance is lost or degraded, it may be necessary to take mitigation measures, such as re-orienting or relocating the ME EQUIPMENT or ME SYSTEM or shielding the location. During this time, the user should stop using the monitor and contact the service personnel.

If the device is operated within the electromagnetic environment listed in Table Guidance and Declaration — Electromagnetic Immunity, the system will remain safe and provide the following essential performance:

■ Operating mode
■ Accuracy
■ Function
■ Accessories identification
■ Data stored
■ Alarm
■ Detect for connection

<table>
<thead>
<tr>
<th>Guidance and Declaration - Electromagnetic Immunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>The device is intended for use in the electromagnetic environment specified below. The customer or the user of the device should assure that it is used in such an environment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Immunity test</th>
<th>IEC60601 test level</th>
<th>Compliance level</th>
<th>Electromagnetic environment - guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic</td>
<td>±8 kV contact ±15 kV</td>
<td>±8 kV contact ±15 kV</td>
<td>Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.</td>
</tr>
<tr>
<td>discharge (ESD)</td>
<td>air</td>
<td>air</td>
<td></td>
</tr>
<tr>
<td>IEC 61000-4-2: 2008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical fast</td>
<td>±2 kV for power supply lines</td>
<td>±2 kV for power supply lines</td>
<td>Mains power quality should be that of a typical commercial or hospital environment.</td>
</tr>
<tr>
<td>transient/burst</td>
<td>±1 kV for input/output lines (length greater than 3 m)</td>
<td>±1 kV for input/output lines (length greater than 3 m)</td>
<td></td>
</tr>
<tr>
<td>IEC 61000-4-4: 2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surge</td>
<td>±1 kV line(s) to line(s) ±2 kV line(s) to earth</td>
<td>±1 kV line(s) to line(s) ±2 kV line(s) to earth</td>
<td></td>
</tr>
<tr>
<td>IEC 61000-4-5: 2014</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage dips and Voltage interruptions</td>
<td>0 % U1 for 0,5 cycle 0 % U1 for 1 cycle and 70 % U1 for 25/30 cycles 0 % U1 for 250/300 cycle</td>
<td>0 % U1 for 0,5 cycle 0 % U1 for 1 cycle and 70 % U1 for 25/30 cycles 0 % U1 for 250/300 cycle</td>
<td>Mains power quality should be that of a typical commercial or hospital environment. If the user of our product requires continued operation during power mains interruptions, it is recommended that our product be powered from an uninterruptible power supply or a battery.</td>
</tr>
<tr>
<td>IEC 61000-4-11: 2004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RATED power frequency magnetic fields</td>
<td>30 A/m 50 Hz / 60 Hz</td>
<td>30 A/m 50 Hz / 60 Hz</td>
<td>Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.</td>
</tr>
<tr>
<td>IEC 61000-4-8: 2009</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: U1 is the AC mains voltage prior to application of the test level.
Guidance and Declaration - Electromagnetic Immunity

The device is intended for use in the specified electromagnetic environment. The customer or the user of the device should assure that it is used in such an environment as described below.

<table>
<thead>
<tr>
<th>Immunity test</th>
<th>IEC60601 test level</th>
<th>Compliance level</th>
<th>Electromagnetic environment - guidance</th>
</tr>
</thead>
</table>
| Conducted disturbances induced by RF fields IEC61000-4-6: 2013                | 3 Vrms              | 3 Vrms           | Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance:
|                                                                                    | 150 kHz to 80 MHz   |                  | 150k to 80 MHz                         |
|                                                                                    | 6 Vrms              | 6 Vrms           | 80 MHz to 2.7 GHz                      |
|                                                                                    | in ISM bands and amateur radio band<sup>a</sup> between 0.15 MHz and 80 MHz |                  | 80 MHz to 30 MHz                       |
| Radiated RF EM fields IEC61000-4-3: 2006+A1:2007+A2:2010                     | 10 V/m              | 10 V/m           | 800 MHz to 2.7 GHz                     |
|                                                                                    | 80 MHz to 2.7 GHz   |                  | 800 MHz to 2.5 GHz                     |
|                                                                                    | 20 V/m              | 20 V/m           | 800 MHz to 2.7 GHz                     |
|                                                                                    | 80 MHz to 2.5 GHz   |                  | where \( P \) is the maximum output power rating of the transmitter in Watts (W) according to the transmitter manufacturer and \( d \) is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey<sup>b</sup>, should be less than the compliance level in each frequency range<sup>c</sup>. Interference may occur in the vicinity of equipment marked with the following symbol: |
|                                                                                    | 380–390 MHz         |                  | 27 V/m                                 |
|                                                                                    | 28 V/m              | 28 V/m           | 27 V/m                                 |
|                                                                                    | 430–470 MHz, 800–960 MHz, 1700–1990 MHz, 2400–2570 MHz |                  | 27 V/m                                 |
|                                                                                    | 9 V/m               | 9 V/m            | 27 V/m                                 |
|                                                                                    | 704–787 MHz, 5100–5800 MHz |                  | 27 V/m                                 |

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

<sup>a</sup>The ISM (industrial, scientific, and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz. The amateur radio bands between 0.15 MHz and 80 MHz are 1.8 MHz to 2.0 MHz, 3.5 MHz to 4.0 MHz, 5.3 MHz to 5.4 MHz, 7 MHz to 7.3 MHz, 10.1 MHz to 10.15 MHz, 14 MHz to 14.2 MHz, 18,07 MHz to 18,17 MHz, 21,0 MHz to 21,4 MHz, 24,89 MHz to 24,99 MHz, 28,0 MHz to 29,7 MHz and 50,0 MHz to 54,0 MHz.

<sup>b</sup>Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey<sup>b</sup>, should be less than the compliance level in each frequency range<sup>c</sup>. Interference may occur in the vicinity of equipment marked with the following symbol:

<sup>c</sup>Over the frequency ranges 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances between Portable and Mobile RF, Communications Equipment and This Equipment

The equipment is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The customer or the user of the device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the device as recommended below, according to the maximum output power of the communication equipment.
B.2 Radio Regulatory Compliance

RF parameters for the Wi-Fi module

<table>
<thead>
<tr>
<th>Item</th>
<th>IEEE 802.11b/g/n (2.4G)</th>
<th>IEEE 802.11a/n (5G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Frequency</td>
<td>ETSI: 2.4 GHz to 2.483 GHz</td>
<td>ETSI: 5.15 GHz to 5.35 GHz, 5.47 GHz to 5.725 GHz</td>
</tr>
<tr>
<td></td>
<td>FCC: 2.4 GHz to 2.483 GHz</td>
<td>FCC: 5.15 GHz to 5.35 GHz, 5.47 GHz to 5.725 GHz to</td>
</tr>
<tr>
<td></td>
<td>MIC: 2.4 GHz to 2.495GHz</td>
<td>5.825GHz</td>
</tr>
<tr>
<td></td>
<td>KC: 2.4 GHz to 2.483 GHz</td>
<td>KC: 5.15 GHz to 5.35GHz, 5.47 to 5.725GHz, 5.725GHz to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.825GHz</td>
</tr>
<tr>
<td>Modulation Mode</td>
<td>DSSS and OFDM</td>
<td>OFDM</td>
</tr>
<tr>
<td>Output power</td>
<td>&lt;30dBm (Peak Power)</td>
<td>&lt;20dBm (Average Power)</td>
</tr>
</tbody>
</table>

This device complies with Part 15 of the FCC Rules and RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications to this equipment not expressly approved by Mindray may cause harmful radio frequency interference and void your authority to operate this equipment.

The maximum antenna gain permitted complies with the e.i.r.p. limits as stated in RSS-210.

The maximum antenna gain permitted complies with the e.i.r.p. limits specified for point-to-point operation, as stated in RSS-210.
### C Default Settings

#### C.1 ECG, Arrhythmia, ST and QT Default Settings

#### C.1.1 ECG Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>Alarm switch: On</td>
</tr>
<tr>
<td></td>
<td>High limit: Adult: 120 bpm</td>
</tr>
<tr>
<td></td>
<td>Pediatric: 160 bpm</td>
</tr>
<tr>
<td></td>
<td>Neonate: 200 bpm</td>
</tr>
<tr>
<td></td>
<td>Low limit: Adult: 50 bpm</td>
</tr>
<tr>
<td></td>
<td>Pediatric: 75 bpm</td>
</tr>
<tr>
<td></td>
<td>Neonate: 100 bpm</td>
</tr>
<tr>
<td></td>
<td>Priority: Med</td>
</tr>
<tr>
<td></td>
<td>Alarm Outputs: Off</td>
</tr>
<tr>
<td></td>
<td>Alarm Source: Auto</td>
</tr>
<tr>
<td>ECG1</td>
<td>II</td>
</tr>
<tr>
<td>ECG2 (5-lead, 6-lead, 12-lead)</td>
<td>V, Va, V1</td>
</tr>
<tr>
<td>Va (for 6-lead only)</td>
<td>Va</td>
</tr>
<tr>
<td>Vb (for 6-lead only)</td>
<td>Vb</td>
</tr>
<tr>
<td>ECG Gain</td>
<td>×1</td>
</tr>
<tr>
<td>Speed</td>
<td>25 mm/sec</td>
</tr>
<tr>
<td>Filter</td>
<td>OR: Surgery</td>
</tr>
<tr>
<td></td>
<td>CCU: Diagnostic</td>
</tr>
<tr>
<td></td>
<td>Other departments: Monitor</td>
</tr>
<tr>
<td>Notch Filter</td>
<td>On</td>
</tr>
<tr>
<td>Lead Set</td>
<td>Auto</td>
</tr>
<tr>
<td>Smart Lead</td>
<td>On</td>
</tr>
<tr>
<td>QRS Volume</td>
<td>General and OR: 2</td>
</tr>
<tr>
<td></td>
<td>Other department: 0</td>
</tr>
<tr>
<td>Baseline Drift Removal (for 12-lead only)</td>
<td>On</td>
</tr>
<tr>
<td>Waveform Layout (for 12-lead only)</td>
<td>Standard</td>
</tr>
<tr>
<td>QRS Threshold</td>
<td>0.16 mV</td>
</tr>
<tr>
<td>Paced</td>
<td>Adult: Unspecified</td>
</tr>
<tr>
<td></td>
<td>Pediatric/neonate: No</td>
</tr>
<tr>
<td>Pacer Reject</td>
<td>Off</td>
</tr>
</tbody>
</table>
## C.1.2 Arrhythmia Default Settings

### C.1.2.1 Arrhythmia Alarm Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Alarm Switch</th>
<th>Priority</th>
<th>Alarm Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asystole</td>
<td>On</td>
<td>High, unadjustable</td>
<td>Off</td>
</tr>
<tr>
<td>V-Fib/V-Tach</td>
<td>On</td>
<td>High, unadjustable</td>
<td>Off</td>
</tr>
<tr>
<td>V-Tach</td>
<td>On</td>
<td>High, unadjustable</td>
<td>Off</td>
</tr>
<tr>
<td>Vent Brady</td>
<td>On</td>
<td>High, unadjustable</td>
<td>Off</td>
</tr>
<tr>
<td>Extreme Tachy</td>
<td>On</td>
<td>High, unadjustable</td>
<td>Off</td>
</tr>
<tr>
<td>Extreme Brady</td>
<td>On</td>
<td>High, unadjustable</td>
<td>Off</td>
</tr>
<tr>
<td>R on T</td>
<td>CCU: On</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Other departments: Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Run PVCs</td>
<td>Off</td>
<td>Low</td>
<td>Off</td>
</tr>
<tr>
<td>Couplet</td>
<td>Off</td>
<td>Prompt</td>
<td>Off</td>
</tr>
<tr>
<td>Multiform PVC</td>
<td>Off</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td>PVC</td>
<td>Off</td>
<td>Prompt</td>
<td>Off</td>
</tr>
<tr>
<td>Bigeminy</td>
<td>CCU: On</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Other departments: Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trigeminy</td>
<td>CCU: On</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Other departments: Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachy</td>
<td>Off</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td>Brady</td>
<td>Off</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td>Pacer Not Capture</td>
<td>Off</td>
<td>Prompt</td>
<td>Off</td>
</tr>
<tr>
<td>Pacer Not Pacing</td>
<td>Off</td>
<td>Prompt</td>
<td>Off</td>
</tr>
<tr>
<td>Missed Beat</td>
<td>Off</td>
<td>Prompt</td>
<td>Off</td>
</tr>
<tr>
<td>Nonsus V-Tach</td>
<td>CCU: On</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Other departments: Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vent Rhythm</td>
<td>CCU: On</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Other departments: Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pause</td>
<td>Off</td>
<td>Low</td>
<td>Off</td>
</tr>
<tr>
<td>Irr Rhythm</td>
<td>Off</td>
<td>Prompt</td>
<td>Off</td>
</tr>
<tr>
<td>A-Fib</td>
<td>Off</td>
<td>Prompt</td>
<td>Off</td>
</tr>
<tr>
<td>PVCs/min</td>
<td>CCU: On</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Other departments: Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pauses/min</td>
<td>CCU: On</td>
<td>Med</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Other departments: Off</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### C.1.2.2 Arrhythmia Threshold Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
<th>Adult</th>
<th>Pediatric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asystole Delay</td>
<td>5 sec</td>
<td>5 sec</td>
<td></td>
</tr>
<tr>
<td>Tachy</td>
<td>120 bpm</td>
<td>160 bpm</td>
<td></td>
</tr>
<tr>
<td>Brady</td>
<td>50 bpm</td>
<td>75 bpm</td>
<td></td>
</tr>
<tr>
<td>Extreme Tachy</td>
<td>160 bpm</td>
<td>180 bpm</td>
<td></td>
</tr>
<tr>
<td>Extreme Brady</td>
<td>35 bpm</td>
<td>50 bpm</td>
<td></td>
</tr>
<tr>
<td>Multiform PVC Window</td>
<td>15 beats</td>
<td>15 beats</td>
<td></td>
</tr>
<tr>
<td>PVCs/min</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Pauses/min</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Pause Threshold</td>
<td>2.0 sec</td>
<td>2.0 sec</td>
<td></td>
</tr>
<tr>
<td>AF/irr Rhy End Time</td>
<td>2 min</td>
<td>2 min</td>
<td></td>
</tr>
<tr>
<td>V-Tach Rate</td>
<td>130 bpm</td>
<td>130 bpm</td>
<td></td>
</tr>
<tr>
<td>V-Brady Rate</td>
<td>40 bpm</td>
<td>40 bpm</td>
<td></td>
</tr>
<tr>
<td>V-Tach PVCs</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>V-Brady PVCs</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

### C.1.3 ST Default Settings

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ST Alarm Mode</td>
<td>Absolute</td>
<td></td>
</tr>
<tr>
<td>ST Alarm Mode set to <strong>Absolute:</strong></td>
<td>Alarm switch</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>High limit</td>
<td>0.2 mV</td>
</tr>
<tr>
<td></td>
<td>Low limit</td>
<td>-0.2 mV</td>
</tr>
<tr>
<td></td>
<td>Priority</td>
<td>Med</td>
</tr>
<tr>
<td></td>
<td>Alarm Outputs</td>
<td>Off</td>
</tr>
<tr>
<td>ST Alarm Mode set to <strong>Relative:</strong></td>
<td>Alarm switch</td>
<td>Off</td>
</tr>
<tr>
<td>ST Single, ST Dual</td>
<td>High limit</td>
<td>0.1 mV</td>
</tr>
<tr>
<td></td>
<td>Low limit</td>
<td>-0.1 mV</td>
</tr>
<tr>
<td></td>
<td>Priority</td>
<td>Med</td>
</tr>
<tr>
<td></td>
<td>Alarm Outputs</td>
<td>Off</td>
</tr>
<tr>
<td>ST Analysis</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>ST Segment</td>
<td>Auto</td>
<td></td>
</tr>
<tr>
<td>Show Marker</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>ST Point</td>
<td>J+60</td>
<td></td>
</tr>
<tr>
<td>Auto Adjust</td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>ISO</td>
<td>-80</td>
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</tr>
</tbody>
</table>
### C.1.4 QT Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔQTc</td>
<td>Alarm switch: Off</td>
</tr>
<tr>
<td>QT Analysis</td>
<td>Off</td>
</tr>
</tbody>
</table>

### C.1.5 Glasgow 12-lead ECG Algorithm Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter</td>
<td>35 Hz</td>
</tr>
<tr>
<td>Baseline Drift Removal</td>
<td>On</td>
</tr>
<tr>
<td>Tachy</td>
<td>100</td>
</tr>
<tr>
<td>Brady</td>
<td>50</td>
</tr>
<tr>
<td>Waveform Layout</td>
<td>Standard</td>
</tr>
<tr>
<td>Median Complex</td>
<td>Off</td>
</tr>
<tr>
<td>Measurements</td>
<td>On</td>
</tr>
<tr>
<td>Interpretation</td>
<td>On</td>
</tr>
<tr>
<td>Interpretation Summary</td>
<td>On</td>
</tr>
</tbody>
</table>

### C.2 Respiration Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
</table>
### C.3 SpO₂ Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO₂ Alarm switch</td>
<td>On</td>
</tr>
<tr>
<td>SpO₂ High limit</td>
<td>Adult: 100%</td>
</tr>
<tr>
<td></td>
<td>Pediatric: 100%</td>
</tr>
<tr>
<td></td>
<td>Neonate: 95%</td>
</tr>
<tr>
<td>SpO₂ Low limit</td>
<td>90%</td>
</tr>
<tr>
<td>SpO₂ Priority</td>
<td>Med</td>
</tr>
<tr>
<td>SpO₂ Alarm Outputs</td>
<td>Off</td>
</tr>
<tr>
<td>SpO₂ Desat Alarm switch</td>
<td>Off</td>
</tr>
<tr>
<td>SpO₂ Desat Low limit</td>
<td>80%</td>
</tr>
<tr>
<td>SpO₂ Desat Priority</td>
<td>High</td>
</tr>
<tr>
<td>SpO₂ Desat Alarm Outputs</td>
<td>Off</td>
</tr>
<tr>
<td>Satsecond (for Nellcor SpO₂)</td>
<td>Off</td>
</tr>
<tr>
<td>NIBP Simul</td>
<td>Off</td>
</tr>
<tr>
<td>Display PI (for Masimo SpO₂)</td>
<td>On</td>
</tr>
<tr>
<td>Speed</td>
<td>25 mm/s</td>
</tr>
</tbody>
</table>
### C.4 Temperature Default Settings

#### C.4.1 Temperature Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Txx (xx refers to temperature site)</td>
<td></td>
</tr>
<tr>
<td>Alarm switch</td>
<td>On</td>
</tr>
<tr>
<td>High limit</td>
<td>38.0 °C</td>
</tr>
<tr>
<td>Low limit</td>
<td>35.0 °C</td>
</tr>
<tr>
<td>Priority</td>
<td>Med</td>
</tr>
<tr>
<td>Alarm Outputs</td>
<td>Off</td>
</tr>
<tr>
<td>ΔT</td>
<td></td>
</tr>
<tr>
<td>Alarm switch</td>
<td>On</td>
</tr>
<tr>
<td>High limit</td>
<td>2.0 °C</td>
</tr>
<tr>
<td>Priority</td>
<td>Med</td>
</tr>
<tr>
<td>Alarm Outputs</td>
<td>Off</td>
</tr>
</tbody>
</table>

### C.5 NIBP Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIBP-S</td>
<td></td>
</tr>
<tr>
<td>Alarm switch</td>
<td>On</td>
</tr>
<tr>
<td>High limit</td>
<td>Adult: 160 mmHg</td>
</tr>
<tr>
<td></td>
<td>Pediatric: 120 mmHg</td>
</tr>
<tr>
<td></td>
<td>Neonate: 90 mmHg</td>
</tr>
<tr>
<td>Low limit</td>
<td>Adult: 90 mmHg</td>
</tr>
<tr>
<td></td>
<td>Pediatric: 70 mmHg</td>
</tr>
<tr>
<td></td>
<td>Neonate: 40 mmHg</td>
</tr>
<tr>
<td>Priority</td>
<td>Med</td>
</tr>
<tr>
<td>Alarm Outputs</td>
<td>Off</td>
</tr>
<tr>
<td>Item</td>
<td>Default Setting</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>NIBP-D</strong></td>
<td><strong>Alarm switch</strong> On</td>
</tr>
</tbody>
</table>
| High limit      | Adult: 90 mmHg  
Pediatric: 70 mmHg  
Neonate: 60 mmHg |
| Low limit       | Adult: 50 mmHg  
Pediatric: 40 mmHg  
Neonate: 20 mmHg |
| Priority        | Med                                                                             |
| Alarm Outputs   | Off                                                                             |
| **NIBP-M**      | **Alarm switch** On                                                              |
| High limit      | Adult: 110 mmHg  
Pediatric: 90 mmHg  
Neonate: 70 mmHg |
| Low limit       | Adult: 60 mmHg  
Pediatric: 50 mmHg  
Neonate: 25 mmHg |
| Priority        | Med                                                                             |
| Alarm Outputs   | Off                                                                             |
| **NIBP-S Extreme** | **Alarm switch** Off                                                          |
| High limit      | Adult: 175 mmHg  
Pediatric: 130 mmHg  
Neonate: 95 mmHg |
| Low limit       | Adult: 75 mmHg  
Pediatric: 60 mmHg  
Neonate: 35 mmHg |
| Priority        | High                                                                            |
| Alarm Outputs   | Off                                                                             |
| **NIBP-D Extreme** | **Alarm switch** Off                                                          |
| High limit      | Adult: 105 mmHg  
Pediatric: 80 mmHg  
Neonate: 65 mmHg |
| Low limit       | Adult: 35 mmHg  
Pediatric: 30 mmHg  
Neonate: 15 mmHg |
| Priority        | High                                                                            |
| Alarm Outputs   | Off                                                                             |
| **NIBP-M Extreme** | **Alarm switch** Off                                                          |
| High limit      | Adult: 125 mmHg  
Pediatric: 100 mmHg  
Neonate: 75 mmHg |
| Low limit       | Adult: 45 mmHg  
Pediatric: 40 mmHg  
Neonate: 20 mmHg |
| Priority        | High                                                                            |
| Alarm Outputs   | Off                                                                             |
### C.6 IBP Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Pressure</td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>160 mmHg</td>
</tr>
<tr>
<td>Pediatric</td>
<td>140 mmHg</td>
</tr>
<tr>
<td>Neonate</td>
<td>90 mmHg</td>
</tr>
<tr>
<td>Interval</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>5 min</td>
</tr>
<tr>
<td>Neonatology</td>
<td>30 min</td>
</tr>
<tr>
<td>Other departments</td>
<td>15 min</td>
</tr>
<tr>
<td>Start Mode</td>
<td>Clock</td>
</tr>
<tr>
<td>NIBP End Tone</td>
<td>Off</td>
</tr>
<tr>
<td>Venipuncture Pressure</td>
<td>Auto</td>
</tr>
<tr>
<td>Display Format</td>
<td>Sys/Dia (Mean)</td>
</tr>
<tr>
<td>Display Alarm Limits</td>
<td>Off</td>
</tr>
<tr>
<td>Display PR</td>
<td>Off</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBP-S Alarm switch</td>
<td>On</td>
</tr>
<tr>
<td>High limit</td>
<td></td>
</tr>
<tr>
<td>Art/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure</td>
<td>160 mmHg</td>
</tr>
<tr>
<td>Adult</td>
<td>160 mmHg</td>
</tr>
<tr>
<td>Pediatric</td>
<td>120 mmHg</td>
</tr>
<tr>
<td>Neonate</td>
<td>90 mmHg</td>
</tr>
<tr>
<td>PA</td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>35 mmHg</td>
</tr>
<tr>
<td>Pediatric and neonate</td>
<td>60 mmHg</td>
</tr>
<tr>
<td>Low limit</td>
<td></td>
</tr>
<tr>
<td>Art/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure</td>
<td>90 mmHg</td>
</tr>
<tr>
<td>Adult</td>
<td>90 mmHg</td>
</tr>
<tr>
<td>Pediatric</td>
<td>70 mmHg</td>
</tr>
<tr>
<td>Neonate</td>
<td>55 mmHg</td>
</tr>
<tr>
<td>PA</td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>10 mmHg</td>
</tr>
<tr>
<td>Pediatric and neonate</td>
<td>24 mmHg</td>
</tr>
<tr>
<td>Priority</td>
<td>Med</td>
</tr>
<tr>
<td>Alarm Outputs</td>
<td>Off</td>
</tr>
<tr>
<td>Item</td>
<td>Alarm switch</td>
</tr>
<tr>
<td>------</td>
<td>--------------</td>
</tr>
<tr>
<td>IBP-D</td>
<td>On</td>
</tr>
</tbody>
</table>
| High limit | • Art/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure  
  Adult: 90 mmHg  
  Pediatric: 70 mmHg  
  Neonate: 60 mmHg  
  • PA  
  Adult: 16 mmHg  
  Pediatric and neonate: 4 mmHg |                |
| Low limit | • Art/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure  
  Adult: 110 mmHg  
  Pediatric: 90 mmHg  
  Neonate: 70 mmHg  
  • PA  
  Adult: 20 mmHg  
  Pediatric and neonate: 26 mmHg  
  • CVP  
  Adult: 14 cmH₂O  
  Pediatric and neonate: 5 cmH₂O  
  • ICP/RAP/LAP/UVP/P1-P4 venous pressure  
  Adult: 10 mmHg  
  Pediatric and neonate: 4 mmHg |                |
| Priority | Med |                |
| Alarm Outputs | Off |                |
| IBP-M | On           |                |
| High limit | • Art/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure  
  Adult: 100 mmHg  
  Pediatric: 70 mmHg  
  Neonate: 50 mmHg  
  • PA  
  Adult: 0 mmHg  
  Pediatric and neonate: -4 mmHg  
  • CVP  
  Adult: 0 cmH₂O  
  Pediatric and neonate: 0 cmH₂O  
  • ICP/RAP/LAP/UVP/P1-P4 venous pressure  
  Adult: 0 mmHg  
  Pediatric and neonate: 0 mmHg |                |
| Low limit | • Art/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure  
  Adult: 50 mmHg  
  Pediatric: 40 mmHg  
  Neonate: 20 mmHg  
  • PA  
  Adult: 0 mmHg  
  Pediatric and neonate: -4 mmHg |                |
<p>| Priority | Med |                |
| Alarm Outputs | Off |                |</p>
<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art-S Extreme</td>
<td>Alarm switch: Off</td>
</tr>
<tr>
<td></td>
<td>High limit: Adult: 175 mmHg, Pediatric: 130 mmHg, Neonate: 95 mmHg</td>
</tr>
<tr>
<td></td>
<td>Low limit: Adult: 75 mmHg, Pediatric: 60 mmHg, Neonate: 50 mmHg</td>
</tr>
<tr>
<td></td>
<td>Priority: High</td>
</tr>
<tr>
<td></td>
<td>Alarm Outputs: Off</td>
</tr>
<tr>
<td>Art-D Extreme</td>
<td>Alarm switch: Off</td>
</tr>
<tr>
<td></td>
<td>High limit: Adult: 105 mmHg, Pediatric: 80 mmHg, Neonate: 65 mmHg</td>
</tr>
<tr>
<td></td>
<td>Low limit: Adult: 35 mmHg, Pediatric: 30 mmHg, Neonate: 15 mmHg</td>
</tr>
<tr>
<td></td>
<td>Priority: High</td>
</tr>
<tr>
<td></td>
<td>Alarm Outputs: Off</td>
</tr>
<tr>
<td>Art-M Extreme</td>
<td>Alarm switch: Off</td>
</tr>
<tr>
<td></td>
<td>High limit: Adult: 125 mmHg, Pediatric: 100 mmHg, Neonate: 75 mmHg</td>
</tr>
<tr>
<td></td>
<td>Low limit: Adult: 55 mmHg, Pediatric: 40 mmHg, Neonate: 30 mmHg</td>
</tr>
<tr>
<td></td>
<td>Priority: High</td>
</tr>
<tr>
<td></td>
<td>Alarm Outputs: Off</td>
</tr>
<tr>
<td>CPP</td>
<td>Alarm switch: On</td>
</tr>
<tr>
<td></td>
<td>High limit: Adult: 130 mmHg, Pediatric: 100 mmHg, Neonate: 90 mmHg</td>
</tr>
<tr>
<td></td>
<td>Low limit: Adult: 50 mmHg, Pediatric: 40 mmHg, Neonate: 30 mmHg</td>
</tr>
<tr>
<td></td>
<td>Priority: Med</td>
</tr>
<tr>
<td></td>
<td>Alarm Outputs: Off</td>
</tr>
<tr>
<td>Measure (for P1, P2)</td>
<td>All</td>
</tr>
<tr>
<td>Measure (for P3, P4)</td>
<td>Mean only</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Med</td>
</tr>
<tr>
<td>Speed</td>
<td>25 mm/sec</td>
</tr>
</tbody>
</table>
### C.7 CO\textsubscript{2} Default Settings

#### C.7.1 General Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EtCO\textsubscript{2}</strong></td>
<td>Alarm switch</td>
</tr>
<tr>
<td>High limit</td>
<td>Adult and pediatric: 50 mmHg</td>
</tr>
<tr>
<td></td>
<td>Neonate: 45 mmHg</td>
</tr>
<tr>
<td>Low limit</td>
<td>Adult and pediatric: 25 mmHg</td>
</tr>
<tr>
<td></td>
<td>Neonate: 30 mmHg</td>
</tr>
<tr>
<td>Priority</td>
<td>Med</td>
</tr>
<tr>
<td>Alarm Outputs</td>
<td>Off</td>
</tr>
<tr>
<td><strong>FiCO\textsubscript{2}</strong></td>
<td>Alarm switch</td>
</tr>
<tr>
<td>High limit</td>
<td>4 mmHg</td>
</tr>
<tr>
<td>Priority</td>
<td>Med</td>
</tr>
<tr>
<td>Alarm Outputs</td>
<td>Off</td>
</tr>
</tbody>
</table>
C.7.2  Sidestream CO₂ Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>EtO₂</td>
<td>Alarm switch: On</td>
</tr>
<tr>
<td></td>
<td>High limit: 88%</td>
</tr>
<tr>
<td></td>
<td>Low limit: 18%</td>
</tr>
<tr>
<td></td>
<td>Priority: Med</td>
</tr>
<tr>
<td></td>
<td>Alarm Outputs: Off</td>
</tr>
<tr>
<td>BTPS Compensation</td>
<td>Off</td>
</tr>
<tr>
<td>O₂ Compensation (for CO₂ module without O₂ measurement)</td>
<td>OR: 100% Other departments: 21%</td>
</tr>
<tr>
<td>N₂O Compensation</td>
<td>0%</td>
</tr>
<tr>
<td>AG Compensation</td>
<td>0%</td>
</tr>
<tr>
<td>Auto Standby</td>
<td>60 min</td>
</tr>
<tr>
<td>Operating Mode</td>
<td>Measure</td>
</tr>
</tbody>
</table>

C.7.3  Microstream CO₂ Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTPS Compen</td>
<td>Off</td>
</tr>
<tr>
<td>Maximum Hold</td>
<td>20 sec</td>
</tr>
<tr>
<td>Auto Standby</td>
<td>Off</td>
</tr>
<tr>
<td>Operating Mode</td>
<td>Measure</td>
</tr>
</tbody>
</table>
## C.8 Alarm Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Volume</td>
<td>2</td>
</tr>
<tr>
<td>High Alarm Volume</td>
<td>Alarm Volume + 2</td>
</tr>
<tr>
<td>Reminder Volume</td>
<td>2</td>
</tr>
<tr>
<td>Zero RR Delay</td>
<td>Adult: 20 sec</td>
</tr>
<tr>
<td></td>
<td>pediatric: 20 sec</td>
</tr>
<tr>
<td></td>
<td>Neonate: 15 sec</td>
</tr>
<tr>
<td>Printing Duration on Alarm</td>
<td>20 sec</td>
</tr>
</tbody>
</table>

## C.9 Display Default Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose Screen</td>
<td>Normal Screen</td>
</tr>
<tr>
<td>Screen Lock Duration</td>
<td>General, CCU: Permanent</td>
</tr>
<tr>
<td></td>
<td>Other departments: 10 sec</td>
</tr>
<tr>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>Brightness</td>
<td>5</td>
</tr>
<tr>
<td>Key Volume</td>
<td>2</td>
</tr>
<tr>
<td>Night Mode</td>
<td></td>
</tr>
<tr>
<td>Brightness</td>
<td>1</td>
</tr>
<tr>
<td>Alarm Volume</td>
<td>2</td>
</tr>
<tr>
<td>QRS Volume</td>
<td>1</td>
</tr>
<tr>
<td>Key Volume</td>
<td>0</td>
</tr>
<tr>
<td>NIBP End Tone</td>
<td>Off</td>
</tr>
<tr>
<td>Stop NIBP</td>
<td>Off</td>
</tr>
</tbody>
</table>
D Alarm Messages

This chapter lists only the most important physiological and technical alarm messages. Some messages appearing on your monitor may not be included. In the “Cause and solution” column, corresponding solutions are given instructing you to troubleshoot problems. If the problem persists, contact your service personnel.

D.1 Physiological Alarm Messages

D.1.1 General Physiological Alarm Messages

<table>
<thead>
<tr>
<th>Alarm messages</th>
<th>Default priority</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX High</td>
<td>Med</td>
<td>XX value has risen above the high alarm limit or fallen below the low alarm limit. Check the patient's condition and check if the patient category and alarm limit settings are correct.</td>
</tr>
<tr>
<td>XX Low</td>
<td>Med</td>
<td></td>
</tr>
</tbody>
</table>

Note: XX represents a measurement or parameter label, such as HR, NIBP, PVCs, RR, SpO₂, PR, etc.

D.1.2 Arrhythmia Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asystole</td>
<td>High</td>
</tr>
<tr>
<td>V-Fib/V-Tach</td>
<td>High</td>
</tr>
<tr>
<td>V-Tach</td>
<td>High</td>
</tr>
<tr>
<td>Vent Brady</td>
<td>High</td>
</tr>
<tr>
<td>Extreme Tachy</td>
<td>High</td>
</tr>
<tr>
<td>Extreme Brady</td>
<td>High</td>
</tr>
<tr>
<td>PVCs/min</td>
<td>Med</td>
</tr>
<tr>
<td>Pauses/min</td>
<td>Med</td>
</tr>
<tr>
<td>R on T</td>
<td>Med</td>
</tr>
<tr>
<td>Bigeminy</td>
<td>Med</td>
</tr>
<tr>
<td>Trigeminy</td>
<td>Med</td>
</tr>
<tr>
<td>Tachy</td>
<td>Med</td>
</tr>
<tr>
<td>Brady</td>
<td>Med</td>
</tr>
<tr>
<td>Multiform PVC</td>
<td>Med</td>
</tr>
<tr>
<td>Vent Rhythm</td>
<td>Med</td>
</tr>
<tr>
<td>Nonsus V-Tach</td>
<td>Med</td>
</tr>
<tr>
<td>Run PVCs</td>
<td>Low</td>
</tr>
<tr>
<td>Pause</td>
<td>Low</td>
</tr>
<tr>
<td>Couplet</td>
<td>Prompt</td>
</tr>
<tr>
<td>PVC</td>
<td>Prompt</td>
</tr>
<tr>
<td>Irr Rhythm</td>
<td>Prompt</td>
</tr>
</tbody>
</table>
Note: When arrhythmia alarms occur, check the patient's condition and the ECG connections.

### D.1.3 Resp Physiological Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resp Artifact</td>
<td>High</td>
<td>The patient's heartbeat has interfered with the impedance respiration measurement. Check the patient's condition and the ECG connections.</td>
</tr>
<tr>
<td>Zero RR</td>
<td>High</td>
<td>The respiration signal is so weak that the monitor cannot perform respiration analysis. Check the patient's condition, module and patient connections.</td>
</tr>
</tbody>
</table>

### D.1.4 SpO₂ Physiological Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO₂ Desat</td>
<td>High</td>
<td>The SpO₂ value falls below the desaturation alarm limit. Check the patient's condition and check if the alarm limit settings are correct.</td>
</tr>
</tbody>
</table>

### D.1.5 PR Physiological Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Pulse</td>
<td>High</td>
<td>The pulse signal is so weak that the monitor cannot perform pulse analysis. Check the patient's condition, SpO₂ sensor and measurement site.</td>
</tr>
</tbody>
</table>

### D.1.6 NIBP Physiological Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIBP-S/NIBP-D/NIBP-M Extremely High</td>
<td>High</td>
<td>The NIBP value is higher than the NIBP Extreme alarm high limit. Check the patient's condition and check if the alarm limit settings are correct.</td>
</tr>
<tr>
<td>NIBP-S/NIBP-D/NIBP-M Extremely Low</td>
<td>High</td>
<td>The NIBP value is lower than the NIBP Extreme alarm low limit. Check the patient's condition and check if the alarm limit settings are correct.</td>
</tr>
</tbody>
</table>

### D.1.7 IBP Physiological Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art-S/Art-D/Art-M Extremely High</td>
<td>High</td>
<td>The Art value is higher than the Art Extreme alarm high limit. Check the patient's condition and check if the alarm limit settings are correct.</td>
</tr>
<tr>
<td>Art-S/Art-D/Art-M Extremely Low</td>
<td>High</td>
<td>The Art value is lower than the Art Extreme alarm low limit. Check the patient's condition and check if the alarm limit settings are correct.</td>
</tr>
</tbody>
</table>
D.1.8  CO₂ Physiological Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>FiO₂ Shortage</td>
<td>High</td>
<td>FiO₂ concentration is less than 18%. Check the patient’s condition, the ventilated O₂ content and the airway connection.</td>
</tr>
</tbody>
</table>

D.2  Technical Alarm Messages

This section lists major technical alarms, their default priority, responses on alarm reset, and the actions that can be taken when an alarm occurs. Some of alarms may not be included.

The various technical alarms respond differently when the alarm system is reset. For easy clarification, in this section the technical alarms are classified into three categories of response when the alarm system is reset:

- **A**: technical alarms are cleared. The monitor gives no alarm indications.
- **B**: technical alarms are changed to prompt messages.
- **C**: the alarm is silenced and a √ appears before the alarm message, indicating that the alarm is acknowledged.

In the following tables A, B, and C are used to refer to the responses on alarm reset.

D.2.1  General Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX Module Error</td>
<td>High</td>
<td>C</td>
<td>XX module does not work properly. Reinsert the module, if the alarm persists, contact your service personnel.</td>
</tr>
</tbody>
</table>

Note: XX represents a measurement or parameter label, such as ECG, SpO₂, NIBP, IBP, CO₂, etc.

D.2.2  ECG Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECG Noisy</td>
<td>Low/Prompt</td>
<td>A</td>
<td>The ECG signal is noisy. Check for any possible sources of signal noise around the cable and electrode, and check the patient for excessive motion.</td>
</tr>
<tr>
<td>ECG Amplitude Too Small</td>
<td>Low</td>
<td>C</td>
<td>The ECG amplitude does not reach the detected threshold. Check for any possible source of interference around the cable and electrode.</td>
</tr>
<tr>
<td>ECG (XX) Lead Off</td>
<td>Low</td>
<td>B</td>
<td>The electrode has become detached from the patient or the lead wire has become disconnected from the adapter cable. Check the connections of the electrodes and leadwires.</td>
</tr>
<tr>
<td>ECG Signal Invalid</td>
<td>Low</td>
<td>A</td>
<td>Patient skin impedance is too high. Check ECG electrode application.</td>
</tr>
<tr>
<td>ECG Learning</td>
<td>Prompt</td>
<td>/</td>
<td>ECG learning is manually or automatically triggered.</td>
</tr>
<tr>
<td>Cannot Analyze QT</td>
<td>Prompt</td>
<td>/</td>
<td>/</td>
</tr>
</tbody>
</table>

Note: XX represents ECG lead name, for example RL, LL, V, Va, Vb, etc.
### D.2.3 Resp Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resp Interference</td>
<td>Prompt</td>
<td>/</td>
<td>The respiration circuit is disturbed. Check for any possible sources of signal noise.</td>
</tr>
<tr>
<td>Electrode Poor Contact</td>
<td>Prompt</td>
<td>/</td>
<td>Check the electrode application. Reposition or replace the electrodes if necessary.</td>
</tr>
</tbody>
</table>

### D.2.4 SpO₂ Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO₂ Sensor Off</td>
<td>Low</td>
<td>B</td>
<td>The SpO₂ sensor has become detached from the patient or the module. Check the sensor connection. If the alarm persists, replace the sensor.</td>
</tr>
<tr>
<td>SpO₂ No Sensor</td>
<td>Low</td>
<td>A</td>
<td>The SpO₂ extension cable is detached from the SpO₂ module, or the SpO₂ sensor is detached from the SpO₂ extension cable. Check the SpO₂ cable and the sensor connection. If the alarm persists, replace the sensor.</td>
</tr>
<tr>
<td>SpO₂ Excess Light</td>
<td>Low</td>
<td>C</td>
<td>Ambient light is too strong. Move the sensor to a place with lower level of ambient light or cover the sensor to minimize the ambient light.</td>
</tr>
<tr>
<td>SpO₂ No Pulse</td>
<td>Low</td>
<td>C</td>
<td>The SpO₂ sensor failed to obtain pulse signal. Check the patient's condition and replace the sensor application site. If the alarm persists, replace the sensor.</td>
</tr>
<tr>
<td>SpO₂ Sensor Incompatible</td>
<td>Low</td>
<td>C</td>
<td>Incompatible or an unspecified SpO₂ sensor is used. Use specified sensors.</td>
</tr>
<tr>
<td>SpO₂ Low Signal Quality</td>
<td>Low</td>
<td>C</td>
<td>1. Check the sensor and sensor position. 2. Make sure the patient is not shivering or moving. 3. The patient's pulse may be too low to be measured.</td>
</tr>
<tr>
<td>SpO₂ Interference</td>
<td>Low</td>
<td>C</td>
<td>The SpO₂ signal interference. Check for any possible sources of signal noise and check the patient for excessive motion.</td>
</tr>
<tr>
<td>SpO₂ Sensor Error</td>
<td>Low</td>
<td>C</td>
<td>Replace the sensor and measure again.</td>
</tr>
<tr>
<td>SpO₂ Searching Pulse</td>
<td>Prompt</td>
<td>/</td>
<td>SpO₂ is searching for pulse.</td>
</tr>
<tr>
<td>SpO₂ Low Perfusion</td>
<td>Prompt</td>
<td>/</td>
<td>The SpO₂ sensor is not properly placed or the patient's perfusion index is too low. 1. Check the sensor and sensor position. 2. Reposition the sensor if necessary.</td>
</tr>
</tbody>
</table>

### D.2.5 Temp Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1/T2 Sensor Off</td>
<td>Low</td>
<td>A</td>
<td>Check the sensor connection and reconnect the sensor.</td>
</tr>
</tbody>
</table>
### D.2.6 NIBP Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIBP Cuff Loose</td>
<td>Low</td>
<td>A</td>
<td>There is a leak in the cuff or air tubing. Use a cuff of correct type based on the patient size. Apply the cuff and connect the air tubing as instructed in the manual.</td>
</tr>
<tr>
<td>NIBP Cuff or Airway Leak</td>
<td>Low</td>
<td>A</td>
<td>Check the NIBP cuff and pump for leakages.</td>
</tr>
<tr>
<td>NIBP Airway Error</td>
<td>Low</td>
<td>A</td>
<td>The air tubing may be occluded. Check the air tubing for an occlusion or kinking. If the alarm persists, contact your service personnel.</td>
</tr>
<tr>
<td>NIBP Weak Signal</td>
<td>Low</td>
<td>A</td>
<td>The patient’s pulse is weak or the cuff is loose. Check the patient’s condition and replace the cuff application site.</td>
</tr>
<tr>
<td>NIBP Overrange</td>
<td>Low</td>
<td>A</td>
<td>The measured NIBP value exceeds the module measurement range. Check the patient’s condition.</td>
</tr>
<tr>
<td>NIBP Excessive Motion</td>
<td>Low</td>
<td>A</td>
<td>Check the patient’s condition and reduce patient motion.</td>
</tr>
<tr>
<td>NIBP Cuff Overpressure</td>
<td>Low</td>
<td>A</td>
<td>The NIBP airway may be occluded. Check the airway and measure again. If the alarm persists, contact your service personnel.</td>
</tr>
<tr>
<td>NIBP Timeout</td>
<td>Low</td>
<td>A</td>
<td>The measurement time exceeds 120 seconds in the adult or pediatric mode, or exceeds 90 seconds in the neonatal mode, and the BP value cannot be obtained. Check the patient’s condition and NIBP connections, or replace the cuff and measure again.</td>
</tr>
<tr>
<td>NIBP Cuff and Patient Mismatch</td>
<td>Low</td>
<td>A</td>
<td>The cuff type mismatches the patient category. Verify the patient category or replace the cuff if necessary. If patient category is correct, check that the tubing is not bent and the airway is not occluded.</td>
</tr>
<tr>
<td>NIBP Airway Leak</td>
<td>Low</td>
<td>A</td>
<td>Airway leakage is found during the NIBP leakage test. Check the NIBP cuff and pump for leakages.</td>
</tr>
</tbody>
</table>

### D.2.7 IBP Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX Sensor Error</td>
<td>Med</td>
<td>C</td>
<td>The IBP sensor fails. Replace the sensor.</td>
</tr>
<tr>
<td>XX No Sensor</td>
<td>Med</td>
<td>A</td>
<td>The IBP patient cable and/or corresponding IBP sensor is not connected or detached. Check the cable and sensor connection.</td>
</tr>
<tr>
<td>XX No Pulse</td>
<td>Low</td>
<td>A</td>
<td>The catheter may be occluded. Please flush the catheter.</td>
</tr>
<tr>
<td>XX Disconnected</td>
<td>High</td>
<td>C</td>
<td>The tubing is disconnected from the patient, or the three-way valve is open to the air. Check the connection of the tubing, or check the valve is open to the patient. If the alarm persists, contact your service personnel.</td>
</tr>
</tbody>
</table>

**Note:** XX represents an IBP label, for example PA, CVP, FAP, P1, etc.
## CO₂ Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
</table>
| CO₂ Module High Temp           | Low              | C                         | Ambient temperature is too high or there is a module failure.  
1. Lower the operating temperature.  
2. Reinsert the module.  
3. If the alarm persists, the CO₂ module may have failed, contact your service personnel. |
| CO₂ Module Low Temp            | Low              | C                         | Ambient temperature is too low or there is a module failure.  
1. Raise the operating temperature.  
2. Reinsert the module.  
3. If the alarm persists, the CO₂ module may have failed, contact your service personnel. |
| CO₂ Zero Failed                | Low              | C                         | Replug the module. If the alarm persists, contact your service personnel.                                                                          |
| CO₂ No Watertrap               | Low              | B                         | Check the watertrap connections.                                                                                                                     |
| CO₂ High Airway Pressure       | Low              | C                         | 1. Check the airway pressure settings of the ventilator/anesthesia machine.  
2. Disconnect the module from the ventilator/anesthesia machine.  
3. Reinsert the module.  
4. If the alarm persists, contact your service personnel. |
| CO₂ Low Airway Pressure        | Low              | C                         | 1. Check the airway pressure settings of the ventilator/anesthesia machine.  
2. Disconnect the module from the ventilator/anesthesia machine.  
3. Reinsert the module.  
4. If the alarm persists, contact your service personnel. |
| High Barometric                | Low              | C                         | The ambient pressure exceeds the operating pressure range or CO₂ module fails.  
1. Make sure that the ambient pressure meets the specifications, and check for sources that affect the ambient pressure.  
2. Reinsert the module. If the alarm persists, contact your service personnel. |
| Low Barometric                 | Low              | C                         | The ambient pressure exceeds the operating pressure range or CO₂ module fails.  
1. Make sure that the ambient pressure meets the specifications, and check for sources that affect the ambient pressure.  
2. Reinsert the module. If the alarm persists, contact your service personnel. |
| CO₂ Airway Occluded            | Low              | C                         | 1. Check if the sample line is kinked or occluded.  
2. Replace the sample line.  
3. Reinsert the module.  
4. If the alarm persists, contact your service personnel. |
| CO₂ No Filterline              | Low              | A                         | Make sure that the filterline is connected.                                                                                                         |
| CO₂ Calibration Required       | Low              | C                         | Perform a calibration.                                                                                                                              |
### D.2.9 Power Supply Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ Airway Error</td>
<td>Low</td>
<td>C</td>
<td>1. Check if the sample line is kinked or occluded. 2. Replace the sample line. 3. Reinsert the module. 4. If the alarm persists, contact your service personnel.</td>
</tr>
<tr>
<td>CO₂ Adapter Error</td>
<td>Low</td>
<td>A</td>
<td>Check, clean or replace the airway adapter. Perform a zero calibration.</td>
</tr>
<tr>
<td>CO₂ No Sensor</td>
<td>Low</td>
<td>A</td>
<td>Make sure that the CO₂ transducer is connected.</td>
</tr>
<tr>
<td>CO₂ Change Watertrap</td>
<td>Low</td>
<td>C</td>
<td>Replace the watertrap.</td>
</tr>
<tr>
<td>CO₂ Watertrap and Patient Mismatch</td>
<td>Low</td>
<td>C</td>
<td>Check the patient category and use a correct watertrap.</td>
</tr>
</tbody>
</table>

### D.2.10 Printer Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Battery</td>
<td>Med</td>
<td>C</td>
<td>Connect the monitor to an AC power source and allow the batteries to charge.</td>
</tr>
<tr>
<td>Critically Low Battery</td>
<td>High</td>
<td>C</td>
<td>Connect the monitor to an AC power source and allow the batteries to charge.</td>
</tr>
<tr>
<td>Battery Service Required</td>
<td>Low</td>
<td>B</td>
<td>The battery has reached its lifetime. Contact your service personnel.</td>
</tr>
<tr>
<td>Power Board Comm Error</td>
<td>High</td>
<td>C</td>
<td>Shutdown and restart the monitor. If the alarm persists, contact your service personnel.</td>
</tr>
<tr>
<td>Battery Error</td>
<td>High</td>
<td>C</td>
<td>The battery may have failed. Contact your service personnel.</td>
</tr>
<tr>
<td>Battery Charging Error</td>
<td>High</td>
<td>C</td>
<td>The charging circuit fails or the battery fails. Contact your service personnel.</td>
</tr>
<tr>
<td>Battery Temperature Too High</td>
<td>High</td>
<td>C</td>
<td>Stop using the monitor after this alarm appears, and contact your service personnel.</td>
</tr>
<tr>
<td>Battery Off</td>
<td>High</td>
<td>C</td>
<td>Shutdown and restart the monitor. If the alarm persists, contact your service personnel.</td>
</tr>
<tr>
<td>RT Clock Need Reset</td>
<td>High</td>
<td>C</td>
<td>Contact your service personnel.</td>
</tr>
<tr>
<td>RT Clock Not Exist</td>
<td>High</td>
<td>C</td>
<td>Contact your service personnel.</td>
</tr>
<tr>
<td>XX V Too High</td>
<td>High</td>
<td>C</td>
<td>There is a problem with the system power supply. Shutdown and restart the monitor.</td>
</tr>
<tr>
<td>XX V Too Low</td>
<td>High</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

XX represents 2.5, 3.3,5, or 12.
### D.2.11 Technical Alarm Messages Related to Networked Monitoring

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printing Stopped</td>
<td>Prompt</td>
<td>/</td>
<td>Printing was manually stopped.</td>
</tr>
<tr>
<td>Printer Unavailable</td>
<td>Prompt</td>
<td>/</td>
<td>The printer may have failed. Check the printer.</td>
</tr>
<tr>
<td>PDF storage space is nearly full</td>
<td>Prompt</td>
<td>/</td>
<td>Delete the files saved under the PDF file path to release storage space. Otherwise you cannot save new PDF files.</td>
</tr>
<tr>
<td>Error storing PDF file</td>
<td>Prompt</td>
<td>/</td>
<td>The PDF file path settings on the printer server and the PDFCreator are not consistent or the PDF storage space is full. Check the PDF file path settings for consistency, or delete the files saved under the PDF file path to release storage space.</td>
</tr>
<tr>
<td>Change the print server language to be consistent with this monitor</td>
<td>Prompt</td>
<td>/</td>
<td>Verify that the language settings of the printer server and the monitor are consistent, Otherwise you cannot perform printing.</td>
</tr>
<tr>
<td>Print Server Disconnected</td>
<td>Prompt</td>
<td>/</td>
<td>Check that the monitor is properly connected with the printer server.</td>
</tr>
</tbody>
</table>

### D.2.12 Other System Technical Alarm Messages

<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>No CMS</td>
<td>Low</td>
<td>B</td>
<td>The monitor is disconnected from the CMS. Check the network connection.</td>
</tr>
<tr>
<td>View Bed XX YY-ZZ, Network Disconnected.</td>
<td>Low</td>
<td>A</td>
<td>The network is interrupted when the monitor is viewing the remote device. Check the network connection.</td>
</tr>
<tr>
<td>Viewed by Bed XX YY-ZZ, Network Disconnected.</td>
<td>Low</td>
<td>A</td>
<td>The network is interrupted when the monitor is viewed by another remote device. Check the network connection.</td>
</tr>
<tr>
<td>WLAN IP Address Conflict</td>
<td>Low</td>
<td>C</td>
<td>There is a wireless network IP address conflicts. Check the network settings.</td>
</tr>
<tr>
<td>LAN1 IP Address Conflict</td>
<td>Low</td>
<td>C</td>
<td>There is a wired network IP address conflicts. Check the network settings.</td>
</tr>
<tr>
<td>Fail To Get WLAN IP Address</td>
<td>Low</td>
<td>C</td>
<td>Unable to automatically obtain the wireless network IP address. Check the network settings.</td>
</tr>
<tr>
<td>Fail To Get LAN1 IP Address</td>
<td>Low</td>
<td>C</td>
<td>Unable to automatically obtain the wired network IP address. Check the network settings.</td>
</tr>
</tbody>
</table>

**Note:** XX refers to the department name, YY refers to the room number, and ZZ refers to the bed number.
<table>
<thead>
<tr>
<th>Alarm message</th>
<th>Default priority</th>
<th>Indication on alarm reset</th>
<th>Cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading Default Config Failed</td>
<td>Low</td>
<td>A</td>
<td>The default configuration was not correctly loaded. The monitor will restore to the factory default configuration for the current patient category.</td>
</tr>
</tbody>
</table>
| Read dock E2PROM error!                           | High             | C                         | 1. Check if you're using the specified external display.  
• If you're using the specified external display, remove the N1 from the Dock, and reconnect the N1 and the Dock.  
• If you're not using the specified external display, replace current external display with the specified external display. Then remove the N1 from the Dock, and reconnect the N1 and the Dock.  
2. If the alarm persists, contact your service personnel. |
| XX Conflicts (XX refers to the module label)       | Prompt           | /                         | The same type of corresponding module being used exceeds the supported number. Remove the conflict module.                                           |
| XX Measurement has been closed (XX refers to the module label) | Prompt           | /                         | The parameter module is disabled. Switch on the module if you want to use it. For more information, see 3.11.1 Switching On or Off a Parameter.     |
| The display setup for XX is disabled. (XX refers to the parameter label) | Prompt           | /                         | The parameter of the newly inserted module is not displayed on the screen. Select a desired area to display the parameter numerics and waveforms. For more information, see 3.11.2 Displaying Parameter Numerics and Waveforms. |
| The patient data storage space is nearly full. Please delete some discharged patients. | Med              | B                         | The storage space of the monitor is full. Delete unnecessary earlier discharged patient.                                                           |
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E.1 The Accuracy of Masimo SpO₂ Sensors

Table information for the plots below show $A_{\text{RMS}}$ values measured with Masimo SET Oximetry Technology in a clinical study.

**Adtx/Pdtx/4000/4001**

![Graph showing $A_{\text{RMS}}$ values for Adtx/Pdtx/4000/4001.]

<table>
<thead>
<tr>
<th>Range</th>
<th>$A_{\text{RMS}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100%</td>
<td>1.64%</td>
</tr>
<tr>
<td>80-90%</td>
<td>1.07%</td>
</tr>
<tr>
<td>70-80%</td>
<td>1.55%</td>
</tr>
</tbody>
</table>

**Inf/Neo/NeoPt/4002/4003/4004/4005**

![Graph showing $A_{\text{RMS}}$ values for Inf/Neo/NeoPt/4002/4003/4004/4005.]

<table>
<thead>
<tr>
<th>Range</th>
<th>$A_{\text{RMS}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100%</td>
<td>1.85%</td>
</tr>
<tr>
<td>80-90%</td>
<td>1.44%</td>
</tr>
<tr>
<td>70-80%</td>
<td>0.89%</td>
</tr>
</tbody>
</table>

*The saturation accuracy of the Neonate and Preterm sensors were validated on adult volunteers and 1% was added to account for the properties of fetal hemoglobin.*
### DCI/DCIP/4050/4051

**Measured ARMS Values**

<table>
<thead>
<tr>
<th>Range</th>
<th>ARMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100%</td>
<td>0.60%</td>
</tr>
<tr>
<td>80-90%</td>
<td>0.54%</td>
</tr>
<tr>
<td>70-80%</td>
<td>0.67%</td>
</tr>
</tbody>
</table>

**Overall Claimed Accuracy Value**

- 70-100%: 2%

### LNCS YI

**Measured ARMS Values**

<table>
<thead>
<tr>
<th>Range</th>
<th>ARMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100%</td>
<td>0.6%</td>
</tr>
<tr>
<td>80-90%</td>
<td>0.5%</td>
</tr>
<tr>
<td>70-80%</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

**Overall Claimed Accuracy Value**

- 70-100%: ± 2%

### 4053

**Measured ARMS Values**

<table>
<thead>
<tr>
<th>Range</th>
<th>ARMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100%</td>
<td>1.45%</td>
</tr>
<tr>
<td>80-90%</td>
<td>1.22%</td>
</tr>
<tr>
<td>70-80%</td>
<td>1.41%</td>
</tr>
</tbody>
</table>

**Overall Claimed Accuracy Value**

- 70-100%: 2%
E.2 The Accuracy of Nellcor SpO₂ Sensors

SpO₂ Accuracy for Nellcor Sensors vs. Co-Oximeters (Arms)

<table>
<thead>
<tr>
<th>SpO₂ Range</th>
<th>100% to 70%</th>
<th>100% to 90%</th>
<th>90% to 80%</th>
<th>80% to 70%</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-100A</td>
<td>1.64%</td>
<td>1.16%</td>
<td>1.67%</td>
<td>2.25%</td>
</tr>
<tr>
<td>D-YS, OXI-P/I, OXI-A/N</td>
<td>2.41%</td>
<td>1.38%</td>
<td>2.50%</td>
<td>3.60%</td>
</tr>
<tr>
<td>MAXAI, MAXPI, MAXII</td>
<td>1.62%</td>
<td>1.49%</td>
<td>1.57%</td>
<td>2.50%</td>
</tr>
<tr>
<td>MAXNI</td>
<td>1.85%</td>
<td>1.71%</td>
<td>1.51%</td>
<td>1.59%</td>
</tr>
</tbody>
</table>

Modified Bland-Altman for SpO₂ - MAXAI, MAXPI, MAXII, MAXNI Sensors: (SpO₂ - SaO₂) vs. SaO₂

Modified Bland-Altman for SpO₂ - DS-100A Sensors: (SpO₂ - SaO₂) vs. SaO₂
Modified Bland-Altman for SpO2 - D-YS, OXI-A/N, OXI-P/I Sensors: (SpO2 - SaO2) vs. SaO2
## Units, Symbols and Abbreviations

### F.1 Units

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>In Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>μA</td>
<td>microampere</td>
</tr>
<tr>
<td>μV</td>
<td>microvolt</td>
</tr>
<tr>
<td>μs</td>
<td>microsecond</td>
</tr>
<tr>
<td>A</td>
<td>ampere</td>
</tr>
<tr>
<td>Ah</td>
<td>ampere hour</td>
</tr>
<tr>
<td>bpm</td>
<td>beat per minute</td>
</tr>
<tr>
<td>bps</td>
<td>bit per second</td>
</tr>
<tr>
<td>°C</td>
<td>centigrade</td>
</tr>
<tr>
<td>cc</td>
<td>cubic centimeter</td>
</tr>
<tr>
<td>cm</td>
<td>centimeter</td>
</tr>
<tr>
<td>dB</td>
<td>decibel</td>
</tr>
<tr>
<td>DS</td>
<td>dyne second</td>
</tr>
<tr>
<td>°F</td>
<td>Fahrenheit</td>
</tr>
<tr>
<td>g</td>
<td>gram</td>
</tr>
<tr>
<td>GHz</td>
<td>gigahertz</td>
</tr>
<tr>
<td>GTT</td>
<td>gutta</td>
</tr>
<tr>
<td>h</td>
<td>hour</td>
</tr>
<tr>
<td>Hz</td>
<td>hertz</td>
</tr>
<tr>
<td>in</td>
<td>inch</td>
</tr>
<tr>
<td>k</td>
<td>kilo</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram</td>
</tr>
<tr>
<td>kPa</td>
<td>kilopascal</td>
</tr>
<tr>
<td>L</td>
<td>litre</td>
</tr>
<tr>
<td>lb</td>
<td>pound</td>
</tr>
<tr>
<td>m</td>
<td>meter</td>
</tr>
<tr>
<td>mAh</td>
<td>milliampere hour</td>
</tr>
<tr>
<td>Mb</td>
<td>mega byte</td>
</tr>
<tr>
<td>mcg</td>
<td>microgram</td>
</tr>
<tr>
<td>mEq</td>
<td>milli-equivalents</td>
</tr>
<tr>
<td>mg</td>
<td>milligram</td>
</tr>
<tr>
<td>min</td>
<td>minute</td>
</tr>
<tr>
<td>ml</td>
<td>milliliter</td>
</tr>
<tr>
<td>mm</td>
<td>millimeter</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>In Full</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>mmHg</td>
<td>millimeters of mercury</td>
</tr>
<tr>
<td>cmH2O</td>
<td>centimeters of water</td>
</tr>
<tr>
<td>ms</td>
<td>millisecond</td>
</tr>
<tr>
<td>mV</td>
<td>millivolt</td>
</tr>
<tr>
<td>mW</td>
<td>milliwatt</td>
</tr>
<tr>
<td>MΩ</td>
<td>megaohm</td>
</tr>
<tr>
<td>nm</td>
<td>nanometer</td>
</tr>
<tr>
<td>rpm</td>
<td>breaths per minute</td>
</tr>
<tr>
<td>s</td>
<td>second</td>
</tr>
<tr>
<td>V</td>
<td>volt</td>
</tr>
<tr>
<td>VA</td>
<td>volt ampere</td>
</tr>
<tr>
<td>Ω</td>
<td>ohm</td>
</tr>
<tr>
<td>W</td>
<td>watt</td>
</tr>
</tbody>
</table>

**F.2 Symbols**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>minus</td>
</tr>
<tr>
<td>–</td>
<td>negative</td>
</tr>
<tr>
<td>%</td>
<td>percent</td>
</tr>
<tr>
<td>/</td>
<td>per; divide; or</td>
</tr>
<tr>
<td>~</td>
<td>to</td>
</tr>
<tr>
<td>+</td>
<td>plus</td>
</tr>
<tr>
<td>=</td>
<td>equal to</td>
</tr>
<tr>
<td>&lt;</td>
<td>less than</td>
</tr>
<tr>
<td>&gt;</td>
<td>greater than</td>
</tr>
<tr>
<td>≤</td>
<td>less than or equal to</td>
</tr>
<tr>
<td>≥</td>
<td>greater than or equal to</td>
</tr>
<tr>
<td>±</td>
<td>plus or minus</td>
</tr>
<tr>
<td>x</td>
<td>multiply</td>
</tr>
<tr>
<td>©</td>
<td>copyright</td>
</tr>
</tbody>
</table>
# Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>In Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>AaDO₂</td>
<td>alveolar-arterial oxygen gradient</td>
</tr>
<tr>
<td>AC</td>
<td>alternating current</td>
</tr>
<tr>
<td>Adu</td>
<td>adult</td>
</tr>
<tr>
<td>AG</td>
<td>anaesthesia gas</td>
</tr>
<tr>
<td>AHA</td>
<td>American Heart Association</td>
</tr>
<tr>
<td>Ao</td>
<td>aortic pressure</td>
</tr>
<tr>
<td>Art</td>
<td>arterial</td>
</tr>
<tr>
<td>ATMP</td>
<td>barometric pressure</td>
</tr>
<tr>
<td>AUC</td>
<td>area under the curve</td>
</tr>
<tr>
<td>aVF</td>
<td>left foot augmented lead</td>
</tr>
<tr>
<td>aVL</td>
<td>left arm augmented lead</td>
</tr>
<tr>
<td>aVR</td>
<td>right arm augmented lead</td>
</tr>
<tr>
<td>awRR</td>
<td>airway respiratory rate</td>
</tr>
<tr>
<td>BAP</td>
<td>brachial arterial pressure</td>
</tr>
<tr>
<td>BL</td>
<td>baseline</td>
</tr>
<tr>
<td>BT</td>
<td>blood temperature</td>
</tr>
<tr>
<td>BTPS</td>
<td>body temperature and pressure, saturated</td>
</tr>
<tr>
<td>CAA</td>
<td>Clinical Assistive Application</td>
</tr>
<tr>
<td>CaO₂</td>
<td>arterial oxygen content</td>
</tr>
<tr>
<td>CCI</td>
<td>continuous cardiac index</td>
</tr>
<tr>
<td>CCO</td>
<td>continuous cardiac output</td>
</tr>
<tr>
<td>CCU</td>
<td>cardiac (coronary) care unit</td>
</tr>
<tr>
<td>CE</td>
<td>Conformité Européenne</td>
</tr>
<tr>
<td>CFI</td>
<td>cardiac function index</td>
</tr>
<tr>
<td>C.I.</td>
<td>cardiac index</td>
</tr>
<tr>
<td>CIS</td>
<td>clinical information system</td>
</tr>
<tr>
<td>CISPR</td>
<td>International Special Committee on Radio Interference</td>
</tr>
<tr>
<td>COMOS</td>
<td>complementary metal oxide semiconductor</td>
</tr>
<tr>
<td>CMS</td>
<td>central monitoring system</td>
</tr>
<tr>
<td>C.O.</td>
<td>cardiac output</td>
</tr>
<tr>
<td>CO₂</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>COHb</td>
<td>carboxyhemoglobin</td>
</tr>
<tr>
<td>Compl</td>
<td>compliance</td>
</tr>
<tr>
<td>CPI</td>
<td>cardiac power index</td>
</tr>
<tr>
<td>CPO</td>
<td>cardiac power output</td>
</tr>
<tr>
<td>CVP</td>
<td>central venous pressure</td>
</tr>
<tr>
<td>DC</td>
<td>direct current</td>
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<td>Abbreviation</td>
<td>In Full</td>
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<td>--------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Des</td>
<td>desflurane</td>
</tr>
<tr>
<td>Dia</td>
<td>diastolic</td>
</tr>
<tr>
<td>dpi</td>
<td>dot per inch</td>
</tr>
<tr>
<td>dPmx</td>
<td>left ventricular contractility</td>
</tr>
<tr>
<td>DVI</td>
<td>digital video interface</td>
</tr>
<tr>
<td>DO₂</td>
<td>oxygen delivery</td>
</tr>
<tr>
<td>DO₂I</td>
<td>oxygen delivery index</td>
</tr>
<tr>
<td>ECG</td>
<td>electrocardiograph</td>
</tr>
<tr>
<td>EDV</td>
<td>end-diastolic volume</td>
</tr>
<tr>
<td>EEC</td>
<td>European Economic Community</td>
</tr>
<tr>
<td>EEG</td>
<td>electroencephalogram</td>
</tr>
<tr>
<td>EMC</td>
<td>electromagnetic compatibility</td>
</tr>
<tr>
<td>EMG</td>
<td>electromyograph</td>
</tr>
<tr>
<td>EMI</td>
<td>electromagnetic interference</td>
</tr>
<tr>
<td>Enf</td>
<td>enflurane</td>
</tr>
<tr>
<td>ESU</td>
<td>electrosurgical unit</td>
</tr>
<tr>
<td>Et</td>
<td>end-tidal</td>
</tr>
<tr>
<td>EtAA</td>
<td>end-tidal anesthetic agent</td>
</tr>
<tr>
<td>EtDes</td>
<td>end-tidal anesthetic agent</td>
</tr>
<tr>
<td>EtEnf</td>
<td></td>
</tr>
<tr>
<td>EtHal</td>
<td></td>
</tr>
<tr>
<td>EtIso</td>
<td></td>
</tr>
<tr>
<td>EtSev</td>
<td></td>
</tr>
<tr>
<td>EtCO₂</td>
<td>end-tidal carbon dioxide</td>
</tr>
<tr>
<td>EtN₂O</td>
<td>end-tidal nitrous oxide</td>
</tr>
<tr>
<td>EtO</td>
<td>ethylene oxide</td>
</tr>
<tr>
<td>EtO₂</td>
<td>end-tidal oxygen</td>
</tr>
<tr>
<td>EVLW</td>
<td>extravascular lung water</td>
</tr>
<tr>
<td>ELWI</td>
<td>extravascular lung water index</td>
</tr>
<tr>
<td>EWS</td>
<td>Early Warning Score</td>
</tr>
<tr>
<td>FAP</td>
<td>femoral arterial pressure</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communication Commission</td>
</tr>
<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
</tr>
<tr>
<td>Fi</td>
<td>fraction of inspired</td>
</tr>
<tr>
<td>FIAA</td>
<td>inspired anesthetic agent</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>In Full</td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>FiDes</td>
<td>inspired anesthetic agent</td>
</tr>
<tr>
<td>FiEnf</td>
<td></td>
</tr>
<tr>
<td>FiHal</td>
<td></td>
</tr>
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<td>Filso</td>
<td></td>
</tr>
<tr>
<td>FiSev</td>
<td></td>
</tr>
<tr>
<td>FiCO2</td>
<td>fraction of inspired carbon oxygen</td>
</tr>
<tr>
<td>FiN₂O</td>
<td>fraction of inspired nitrous oxide</td>
</tr>
<tr>
<td>FiO₂</td>
<td>fraction of inspired oxygen</td>
</tr>
<tr>
<td>FPGA</td>
<td>field programmable gate array</td>
</tr>
<tr>
<td>FV</td>
<td>flow-volume</td>
</tr>
<tr>
<td>GCS</td>
<td>Glasgow Coma Scale</td>
</tr>
<tr>
<td>GEDV</td>
<td>global end diastolic volume</td>
</tr>
<tr>
<td>GEDI</td>
<td>global end diastolic volume index</td>
</tr>
<tr>
<td>GEF</td>
<td>global ejection fraction</td>
</tr>
<tr>
<td>Hal</td>
<td>halothane</td>
</tr>
<tr>
<td>Hb</td>
<td>hemoglobin</td>
</tr>
<tr>
<td>Hct</td>
<td>haematocrit</td>
</tr>
<tr>
<td>HIS</td>
<td>hospital information system</td>
</tr>
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<td>HR</td>
<td>heart rate</td>
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<td>invasive blood pressure</td>
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<td>IBW</td>
<td>ideal body weight</td>
</tr>
<tr>
<td>ICG</td>
<td>impedance cardiography</td>
</tr>
<tr>
<td>ICP</td>
<td>intracranial pressure</td>
</tr>
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