# User Manual

# Telemetry Monitor

# TM70

# Mindray

Shenzhen Mindray BIO-Medical electronics Co.,LTD.
Mindray Building, Keji 12th Road South, Hi-tech Ind, Shenzhen, China

■ Release time: 2019-10

■ Revision: 4.0

**WARNING**

- **Federal Law (USA) restricts this device to sale by or on the order of a physician or other practitioner licensed by U.S. state law to use or order the use of this device.**

# Intellectual Property Statement



# Manufacturer's Responsibility

Contents of this manual are subject to changes without prior notice.

All information contained in this manual is believed to be correct. Mindray shall not be liable for errors contained herein nor for incidental or consequential damages in connection with the furnishing, performance, or use of this manual.

Mindray is responsible for the effects on safety, reliability and performance of this product, only if:

- all installation operations, expansions, changes, modifications and repairs of this product are conducted by Mindray authorized personnel;
- 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 employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or personal injury.**

# Warranty

Mindray warrants that components within its products will be free from defects in workmanship and materials for a period of three years from the date of purchase except that disposable or one-time use products are warranted to be free from defects in workmanship and materials up to a date one year from the date of purchase or the date of first use, whichever is sooner.

This warranty does not cover consumable items such as, but not limited to, batteries, external cables, and sensors.

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Mindray's obligation or liability under this warranty does not include any transportation or other charges or liability for direct, indirect or consequential damages or delay resulting from the improper use or application of the product or the use of parts or accessories not approved by Mindray or repairs by people other than Mindray authorized personnel.

This warranty does not extend to:

- Malfunction or damage caused by improper use or man-made failure.
- Malfunction or damage caused by unstable or out-of-range power input.
- Malfunction or damage caused by force majeure events, such as (i) flood, fire and earthquake or other similar elements of nature or acts of God; (ii) riots, war, civil disorders, rebellions, or revolutions in any country; or (iii) any other cause beyond the reasonable control of Mindray.
- Malfunction or damage caused by improper operation or repair by unqualified or unauthorized service people.
- Malfunction of the instrument or part whose serial number is not legible.
- Others not caused by instrument or part itself.

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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 your product. If you have any questions, please contact Mindray.

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 critically ill patients.

## Illustrations

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

## Conventions

- *Italic text* is used in this manual to quote the referenced chapters or sections.
- [ ] is used to enclose screen texts.
- → is used to indicate operational procedures.

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# Contents

# 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 to ensure that you get the most from your product.**

### 1.1.1 Warnings

**WARNING**

- **The TM80/TM70 is intended to be used for a single patient at a time.**
- **The TM80/TM70 must be operated by medical personnel in hospitals.**
- **To avoid explosion hazard, do not use the equipment in the presence of oxygen-rich atmospheres, flammable anesthetics, or other flammable agents.**
- **Do not use TM80/TM70 in conjunction with Electro Surgical Unit (ESU).**
- **Do not expose the TM80/TM70 to a Magnetic Resonance (MR) environment.**
  - **Thermal injury and burns may occur due to the metal components of the equipment which can heat during MR scanning.**
  - **The equipment may present a risk of projectile injury due to the presence of ferromagnetic materials which can be attracted by the MR magnet core.**
  - **The leadwires and electrodes will generate artifacts in the MR image.**
  - **The equipment will not function properly due to the strong magnetic and radio frequency fields generated by the MR scanner.**
- **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.**
- **Do not come into contact with the patient during defibrillation. Otherwise serious injury or death could result.**
- **Do not touch the patient and live parts simultaneously.**
- **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 monitoring. Adjustment of alarm volume to a low level may result in a hazard to the patient. Always keep the patient under close surveillance.**
- **The physiological data and alarm messages displayed on the TM80/TM70 are for reference only and cannot be directly used for diagnostic interpretation.**
- **Do not operate the touch screen with water on the hand.**

**WARNING**

- **Only use parts and accessories specified in this manual.**
- **Route, wrap and secure the cables to avoid inadvertent disconnection, stumbling and entanglement**

### 1.1.2 Cautions

**CAUTION**

- **Do not let the display of the TM80/TM70 directly touch the patient when the display is on.**
- **When the Central Monitoring System presents the alarm "Offline" for TM80/TM70, the setting being performed on the TM80/TM70 may not be transferred to the Central Monitoring System. Check the patient condition and the settings on the Central Monitoring System.**
- **When disposing of the packaging material, be sure to observe the applicable waste control regulations and keep it out of children's reach.**
- **The patient should be required to move in a specified area. If the patient is at the edge of or outside the network coverage range, unstable network connection may compromise the monitoring performance. The patient's location is of vital importance for the TM80/TM70. If a life-threatening situation occurs for a patient, this patient must be located and found by medical staff immediately.**
- **Magnetic and electrical fields are capable of interfering with the proper performance of the equipment. For this reason make sure that all external equipment operated in the vicinity of the equipment comply with the relevant EMC requirements. Mobile phone, X-ray equipment or MRI equipment are a possible source of interference as they may emit higher levels of electromagnetic radiation.**
- **Always install or carry the TM80/TM70 properly to avoid damage caused by drop, impact, strong vibration or other mechanical force.**
- **Dry the TM80/TM70 immediately in case of rain or water spray.**

**CAUTION**

- **The TM80/TM70 generates and uses the Radio Frequency (RF) energy. If it is not installed correctly or not used as per the manual, RF interference to other equipment could result.**
- **Signal quality can be impacted on an ambulatory patient by the construction materials used within the hospital.**
- **At the end of its service life, the equipment, and 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**

- **Put the equipment in a location where you can easily view and operate the equipment.**
- **The equipment uses a mains plug as isolation means to the mains power supply. Please do not locate the equipment in a place difficult to operate the mains plug.**
- **In normal use, the operator shall stand in front of the equipment.**
- **The software was developed in compliance with IEC60601-1-4. The possibility of hazards arising from software errors is minimized.**
- **This manual describes all features and options. Your equipment may not have all of them.**
- **Keep this manual in the vicinity of the equipment so that it can be obtained conveniently when needed.**

## 1.2 Equipment Symbols

| Symbol | Description | Symbol | Description |
|---|---|---|---|
|  | Power On/Off key |  | Main menu key |
|  | Nurse call key |  | Symbol for aligning the $SpO_2$ connector |
|  | Charge indicator |  | Refer to instruction manual/booklet |
|  | Defibrillation-proof Type CF applied part | SN | Serial number |
|  | Date of Manufacture |  | Symbol for "MANUFACTURER" |
|  | MR Unsafe – do not subject to magnetic resonance imaging (MRI) | IPX7 | Protection against fluid ingress |
|  | Interference may occur in the vicinity of equipment marked with this symbol |  | General warning sign |
| ETL CLASSIFIED<br>C ETL US<br>Intertek<br>3179617 | The presence of this label indicates the machine was certified by ETL with the statement:<br>Conforms to AAMI Std ES 60601-1, IEC 60601-1-6, IEC Std 60601-1-8, IEC Std 60601-2-27, IEC Std 60601-2-49, ISO Std 80601-2-61, IEC Std. 80601-2-30,<br>Certified to CSA Std C22.2 NO. 60601-1, NO. 60601-1-6, NO. 60601-1-8, NO.60601-2-27, NO. 60601-2-49, NO.80601-2-61, NO.80601-2-30 | | |

**NOTE**

- **Some symbols may not appear on your equipment.**

# 2 General Product Description

## 2.1 Indications for Use

The TM80/TM70 telemetry monitor is intended for use on Adult and Pediatric patients over three years old to monitor ECG, $SpO_2$, NIBP and Resp physiological data. The physiological data can be analyzed, alarmed, stored, reviewed locally on the display of the monitor, and the CentralStation can config and display the physiological parameters from the TM80/TM70.

The TM80/TM70 telemetry monitor is intended for use in professional healthcare facili

ties under the direct supervision of a licensed healthcare practitioner.

**WARNING**

- **Only skilled/trained clinical professionals should operate the TM80/TM70.**
- **The TM80/TM70 telemetry monitor is not designed for monitoring critically ill patients.**
- **If the accuracy of any value displayed at the Central Monitoring System (hereinafter abbreviated as CMS) or TM80/TM70 is questionable, determine the patient's vital signs by alternative means and verify that the telemetry device is working correctly.**
- **The TM80/TM70 telemetry monitor transmits the data through the wireless connection. There might be a risk of data loss.**

## 2.2 Applied Parts

The TM80/TM70 has the following applied parts:

- ECG leadwires
- $SpO_2$ cables
- $SpO_2$ sensors
- NIBP cuffs

## 2.3 Network Components of TM80/TM70

TM80/TM70 network consists of the following components:

■ Central Monitoring System (CMS):

The BeneVision Central Monitoring System ( CMS) is a networked patient monitoring system intended for use in a fixed location, installed in professional healthcare facilities to provide clinicians remote patient monitoring.

■ AC70:

The AC70 is the access controller for AP70 and TM70 management and event review.

■ SYNC70:

SYNC70 is used to synchronize time between AP70s and TM70s to reduce wireless interference.

■ AP70/AP:

The AP70 is used to bridge TM70 to the wired network while AP is used to bridge TM80 to the wired network.

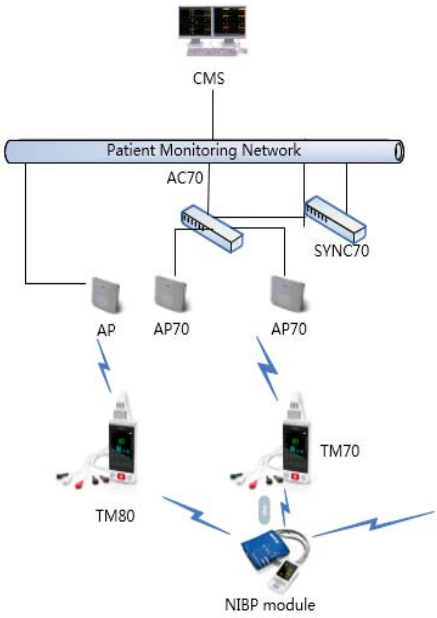
■ TM80/TM70

The TM80/TM70 is used to monitor the patient's ECG, SpO2, NIBP, and Resp physiological data.

■ NIBP module

NIBP module is used to measure, display, review, store the NIBP parameter for ambulating adult and pediatric patients, and transfer the information to other devices in this system.

The AC70, CMS, and SYNC70 are connected with the AP70/AP through the wired network. The TM80/TM70 is connected with the AP70/AP through the wireless network.




TM80/TM70 Network Components

## 2.4 Key Features

- 3.5" color PTC touch screen display is easy for clinicians to use.
- Small, portable, and lightweight for patients to wear.
- The TM80/TM70 supports 3/5/6-lead ECG.
- Supports Masimo $SpO_2$ module, Nonin $SpO_2$ module, and Nellcor $SpO_2$ module.
- Communication to the CMS utilizes WLAN for the TM80/TM70.
- Displays the battery status and supports the multiple levels of battery alarms.
- Displays Heart Rate (HR) , Resp, $SpO_2$, and NIBP parameter numerics and ECG, $SpO_2$, and Resp waveforms.
- Battery options of three AA or lithium-ion battery pack are available.
- Supports parameter auto-sizing.

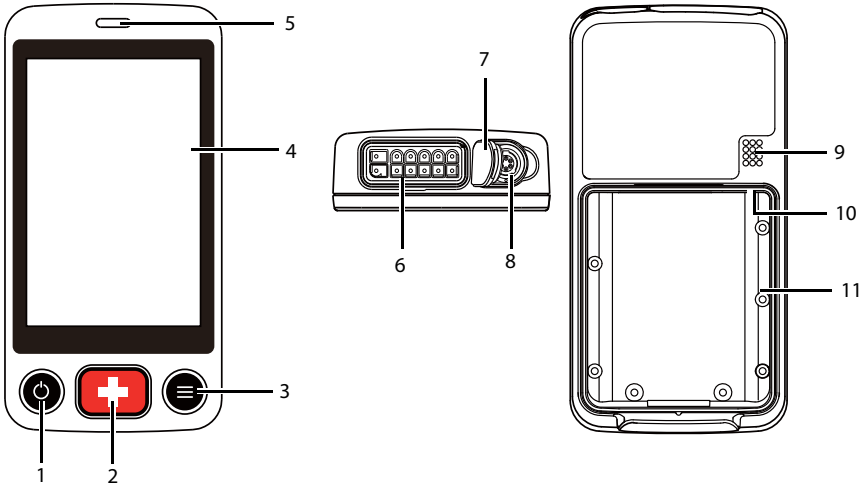
## 2.5 System Components

The TM80/TM70 telemetry monitor includes the following components:

- TM80/TM70 Telemetry Monitor main unit
- NIBP module (BP10)
- Central charger
- Accessories

This manual only describes the TM80/TM70 Telemetry Monitor main unit (hereinafter called the TM80/TM70). For information about the BP10, the central charger, and the central monitoring system, refer to ***BP10 NIBP Module Operator's Manual (P/N 046-008269-00)***, ***BeneVison Central Charger Operator's Manual (P/N 046-007059-00)***, and ***BeneVision Central Monitoring System Operator's Manual (P/N 046-007960-00)*** respectively.

## 2.6 Physical View




1. Display Activation (Power On/Off) key

   When the device is powered off

   - Pressing this key will turn the device on.

   When the device is powered on

   - If the screen display is on, pressing this key will turn the display off.
   - If the screen display is off, pressing this key will turn the display on.
   - Press and hold this key for two seconds to display the power off confirmation menu.

2. Nurse Call key

   Pressing this key will send a nurse call request to the CMS. The alarm light/indicator will illuminate cyan, and a "Nurse Call Initiated" message will display in the message area if the display is on.

3. Main Menu key

   - Pressing this key when on the main screen will open the main menu.
   - Pressing this key when a menu is open will return to the main screen.
   - Pressing this key when the display is off will turn the display on.
   - Pressing this key when the screen lock mode is configured for View Only will display the [**Screen Locked**] menu.

4. Display

The touch screen is the primary user interface for operating the device and viewing information (or patient data).

5. Alarm light/indicator

   Flashes in different color and frequency corresponding to the alarm level.

6. ECG connector

   Connects the ECG leadset.

7. $SpO_2$ cap

   Covers $SpO_2$ connector when $SpO_2$ is not in use.

8. $SpO_2$ connector

   Connects the $SpO_2$ module.

9. Speaker
10. USB connector

    It is only available for authorized service personnel.

11. Battery compartment

    Contains the lithium-ion battery pack or AA battery frame.

## 2.7 Touch Screen Display

**WARNING**

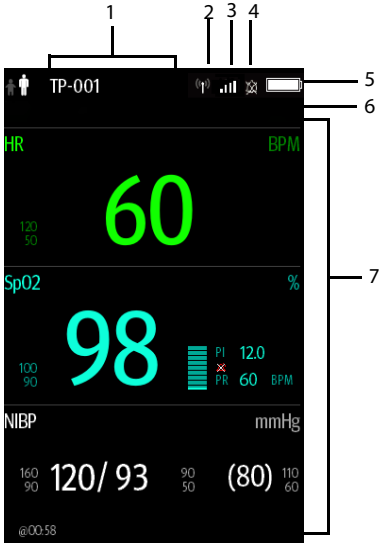
- **Do not operate the touch screen with water on the hand.**

Move your finger on the touch screen display to operate the TM80/TM70. For details about the supported touch gestures, refer to ***"Understanding the Screen Display Orientation" on page 3 - 10***.

## 2.7.1 Display Screen

The main screen displays patient parameters and waveforms. A typical display screen of TM80/TM70 is shown below.


TM80




TM70

1. Patient information area

   This area shows the patient information such as patient size, device name, department name, room number, and bed number. Tapping this area displays the [**Patient Info**] menu.

2. Mindray Patient Area Network (herein abbreviated as MPAN) indicator

   -  indicates that the TM80/TM70 is not paired with the BP10 or one TM80/TM70 is not connected to another TM80/TM70 for configuration transfer.
   -  indicates that the TM80/TM70 is paired with the BP10 successfully or configuration transfer of the TM80/TM70 is in progress.

3. Wireless symbol

   -  /  indicates that the TM80/TM70 has been connected to the wireless access point and the signal coverage is very good. Stable data transmission via wireless network can be guaranteed.
   -  /  indicates that the TM80/TM70 has been connected to the wireless access point and the signal coverage is good. Stable data transmission via wireless network can be guaranteed.
   -  /  indicates that the TM80/TM70 has been connected to the wireless access point and the signal coverage can basically meet the requirements. Stable data transmission via wireless network can be guaranteed.
   -  /  indicates that the TM80/TM70 has been connected to the wireless access point and the signal coverage is weak. wireless offline may occur.
   -  /  indicates that the TM80/TM70 is not connected to the wireless access point.

4. Alarm symbols

   -  indicates that all the alarms are paused.
   -  indicates that the alarm system is reset.
   -  indicates that the alarm audio is turned off.

5. Battery symbol

   This symbol indicates the battery charge status. For details about the battery status symbols, refer to ***"Checking the Battery Charge Status" on page 14 - 4***. Tapping the battery symbol opens the [**System Info**] menu to the battery section.

6. Message area

   This area shows physiological alarm messages, technical alarm messages, and informational messages, where there are multiple messages, the messages scroll.

Tapping this area displays the [**Alarm Summary**] menu, where you can view alarm messages.

7. Patient data area

   This user configurable area can display parameter/waveform data. The parameter/waveform is labeled in the upper left corner. You may also tap this area to display the Setup menu for the corresponding parameter/waveform.

For details about the touch screen operations, refer to ***"Basic Operations" on page 3 - 10***.

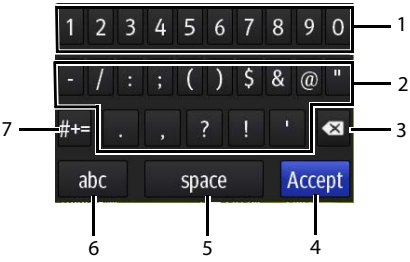
## 2.7.2 On-Screen Keyboard

The TM80/TM70 uses an on-screen keyboard to enter alphanumeric information, such as the device name and passwords.

### 2.7.2.1 Alphabetic Keyboard


1. Alphabetic buttons: tap to input the desired alphabetic text.
2. Delete button: tap to erase the text to the left of the cursor.
3. Accept button: tap to save the settings and exit the keyboard.
4. Space button: tap to input a space.
5. Numeric switch button: tap to switch to the numeric layout.
6. Case shift button: tap to switch the case of the letter.
   This switch is active for one character entry.

### 2.7.2.2 Numeric Keyboard



1. Numeric buttons: tap to input the desired numbers.
2. Punctuation buttons: tap to input the desired punctuation mark or symbol.
3. Delete button: tap to erase the text to the left of the cursor.
4. Accept button: tap to save the settings and exit the keyboard.
5. Space button: tap to input a space.
6. Alphabetic switch button: tap to switch to the alphabetic layout.
7. More punctuation buttons: tap to display the punctuation keyboard, as shown below.

# 3 Getting Started

**WARNING**

- **The network shall be installed by Mindray authorized personnel.**
- **The software equipment copyright is solely owned by Mindray. No organization or individual shall resort to altering, copying, or exchanging it or to any other infringement on it in any form or by any means without due permission.**
- **Connect only approved devices to this system. 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 is 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 manufacturers or else an expert in the field, to ensure the necessary safety of patients and all devices concerned will not be impaired by the proposed combination.**
- **Contact Mindray to relocate the TM80/TM70.**
- **Only Mindray authorized personnel can update the TM80/TM70.**

## 3.1 Unpacking and Checking

Before unpacking, examine the packing case 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 device and accessories carefully. Check all materials against the packing list and check for any mechanical damage. Contact Mindray in case of any problem.

**WARNING**

- **Before use, please verify whether the packages are intact, especially the packages of single use accessories. In case of any damage, do not apply it to patients.**

**NOTE**

- **Save the packing case and packaging material as they can be used if the device must be reshipped.**

## 3.2 Environmental Requirements

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

The equipment operating environment should be reasonably free from noises, vibration, dust, corrosive, flammable and explosive substances.

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

**WARNING**

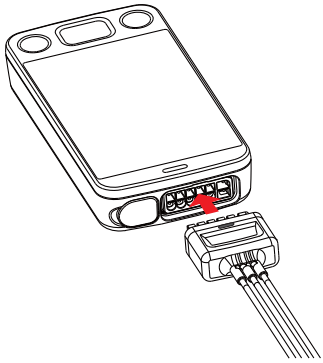
- **Make sure that the device operating environment meets the specifications. Otherwise unexpected consequences, e.g. damage to the device, could result.**

**NOTE**

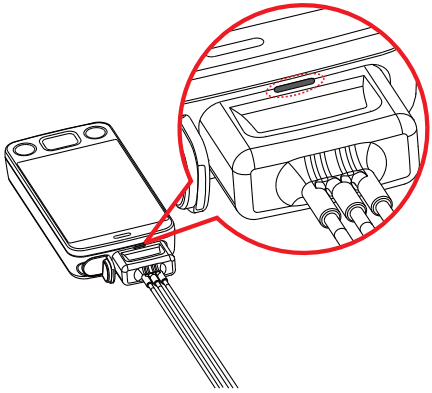
- **The system transmits data through a wireless connection. External radio frequency interference may result in occasionally data dropout. Contact Mindray for any questions regarding the electromagnetic environment.**

## 3.3 Connecting the ECG Leadwire

1. Align the ECG leadwire plug with the ECG connector as indicated by the arrow in the following figure.



2. Insert the ECG leadwire plug into the ECG connector as shown in the enlarged figure below.



**WARNING**

- **Insert the ECG lead set into the ECG connector. The following performance may be affected by a weak connection:**
  - **ECG signal quality**
  - **Wireless signal strength**
  - **Water resistance**
- **Do not use the ECG leadwire to move or lift the TM80/TM70. This may cause the device to fall, which may damage the equipment or injure the patient.**

**NOTE**

- **Insert the $SpO_2$ cap in the $SpO_2$ connector when $SpO_2$ is not in use.**

## 3.4 Installing the Batteries

You can use three AA batteries or a lithium-ion rechargeable battery pack to run the TM80/TM70.

The runtime is dependent on the battery solution your chose. A lithium-ion battery pack will provide the longest runtime. For details about the recommended AA batteries, refer to ***"Miscellaneous" on page 18 - 6***.

**NOTE**

- **Always keep the battery compartment dry.**
- **Never use brute force to install the lithium-ion battery pack or AA battery frame. Otherwise the waterproof ring surrounding the battery frame edge may be broken to affect the waterproof performance.**

### 3.4.1 Installing the Lithium-ion Rechargeable Battery

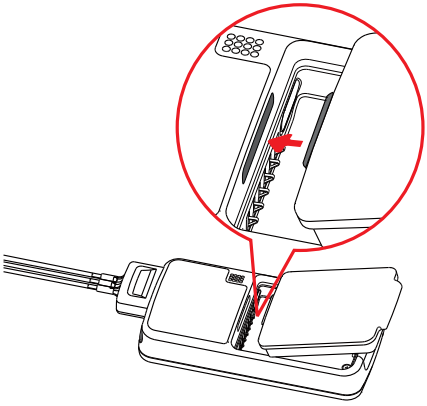
**WARNING**

- **Only use specified lithium-ion rechargeable batteries. Use of other lithium-ion batteries will adversely affect the batteries:**
  - **Level reporting**
  - **Low battery alarms**
  - **Life performance**

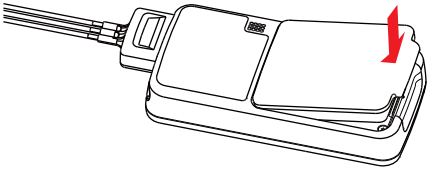
**NOTE**

- **The lithium-ion rechargeable battery should be fully charged prior to first use.**

1. Make sure the battery compartment is empty.
2. Align the hook on the upper part of the lithium-ion battery pack with the slot on the battery compartment, as indicated by the enlarged figure below.



3. Press down the battery pack until it is installed firmly, as indicated by the arrow in the following figure.

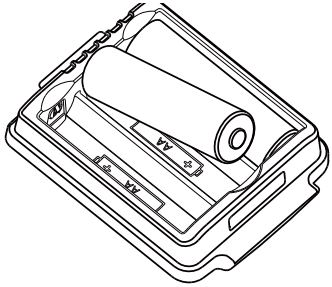


The TM80/TM70 is automatically powered on after the battery is installed.

## 3.4.2 Installing the AA Batteries

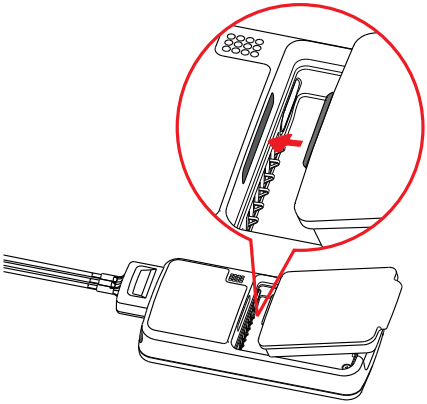
To install the AA batteries:

1. Make sure the battery compartment is empty.
2. Insert three 1.5V alkaline AA batteries according to the diagram in the bottom of the battery frame as shown in the images below.

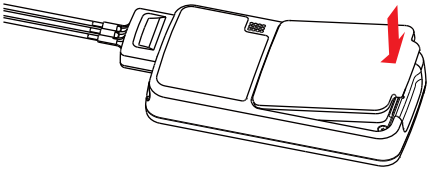


Installing three AA batteries

3. Align the hook on the upper part of the battery frame with the slot on the battery compartment, as indicated by the enlarged part in the following figure.



4. Press down the battery frame until it closes firmly, as indicated by the arrow in the following figure.



The TM80/TM70 is automatically powered on after the batteries are installed.

## 3.5 Powering On the Unit

Press the key to turn on the TM80/TM70. The cyan alarm light will momentarily turn on to indicate that the device is starting. The TM80/TM70 performs a self-test during startup. The alarm light flashes red, yellow, and cyan in turn, and then off. This indicates that the alarm system functions correctly.

Upon powering up, there are two situations:

- If the TM80/TM70 is turned on at first time, the device will request you to configure first time startup.
- If the TM80/TM70 is turned on next time, the device will prompt whether it is a new patient. Select [**Yes**] or [**No**] as desired. If the device is a lock mode, a passcode is required.

**WARNING**

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

## 3.6 Understanding Touch Gestures

Before using the TM80/TM70, understand the supported touch screen gestures:

| Gesture | Description |
|---|---|
|  Tap | Briefly touch the surface with your fingertip to select a target. |
|  Press and hold | Touch the surface for extended period of time. |
|  Drag | Move your fingertip over the surface without losing contact. |
|  Flick | Quickly brush the surface with your fingertip. |

# 3.7 Basic Operations

This section describes the basic operations for the TM80/TM70.

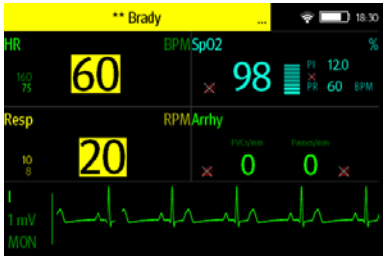
**WARNING**

- **Patients should be instructed not to interact with the display of the device and to not open the battery compartment while the TM80/TM70 is in use.**

## 3.7.1 Understanding the Screen Display Orientation

The TM80/TM70 supports both the portrait and landscape display orientations.


Example of portrait display




Example of landscape display

- Portrait: both digital and waveform tiles take up the entire width of the screen.
- Landscape: the digital tile takes up one half of the width of the screen; the waveform tile takes up the entire width of the screen.

## 3.7.2 Browsing the Screen Display

- To scroll the screen display, drag your finger up or down on the screen.
- To quickly move through the parameters, flick your finger up or down on the screen.

### 3.7.3 Switching the Screen Display Orientation

1. Flick your finger down from the top of the main screen to display the screen orientation switch buttons.
   -  : switches portrait display to landscape display counterclockwise.
   -  : switches portrait display to landscape display clockwise.
   -  switches landscape display horizontally.
   -  : switches landscape display to portrait display.
2. Tap the desired button.

### 3.7.4 Displaying the Quick Keys Area

Flick your finger up from the bottom of the main screen to display the quick keys area.

The following table lists the six default quick keys:

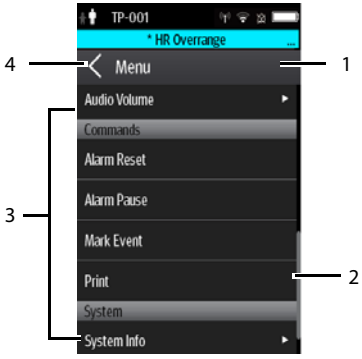
| Quick keys | Description |
|---|---|
| Discharge Patient | Tap the button to enter the [**Discharge Patient**] menu. Refer to ***"Discharging the Patient" on page 5 - 4*** for details. |
| Change Lead | Tap the button to change the current first ECG lead waveform to the next ECG lead waveform that is available in sequential order.<br>For example, if the current first ECG lead waveform is I lead, tap the button, the I lead waveform is changed to II lead waveform. |
| Alarm Pause | Tap the button to pause the alarm system. Refer to ***"Pausing Alarms" on page 6 - 8*** for details. |
| Print | Tap the button to notify the Central Monitoring System (CMS) to start real-time print. The "Print Initiated" message displays on the screen. |
| Mark Event | Tap the button to notify the CMS to save the event to the event database. The "Event Marked" message displays on the screen. |
| Alarm Reset | Tap the button to reset the alarm system. Refer to ***"Resetting Alarms" on page 6 - 9*** for details. |

You can customize the most frequently used functions to the quick keys. For details about setting the quick keys, refer to ***"Quick Keys Menu" on page 13 - 6***.

## 3.7.5 Entering the Main Menu

Press the key to enter the main menu.

The main menu allows access to most of the system functions and settings.




Example of the Main Menu

All menus contain the following parts:

1. Heading: displays the current menu title.
2. Scroll bar: drag the bar to scroll the menu.
3. Main body: contains menus, buttons, and other controls to configure and operate the device.

| Controls | Description |
|---|---|
| ▶ | Accesses a submenu to reveal more options or information. |
| 🔒 | Indicates that a password is required for access. |
| Submenus | Contains more operations or information related to the corresponding menu. |
| Buttons | Provides an option to operate a function. |
| Switch | Drag to right to enable the switch; drag to left to disable the switch. |

4. exits the current menu and return to the previous menu or the main screen, and saves any modified settings.

### 3.7.6 Turning the Display Off

You can manually turn the display off, or let the display automatically turn off based on the configured timeout.

Press the key to manually turn the display off.

If the touch screen is not touched for the configured Display Auto Off time, then the screen will turn off after the configured Display Auto Off time.

For details about configuring the time for Display Auto Off, refer to ***"Configuring the General Menu" on page 13 - 2***.

**NOTE**

- **While the display is off, the TM80/TM70 enters the power saving mode, and does not provide audio and visual alarms.**

### 3.7.7 Turning the Display On

If the screen is off, press the or key to turn the display on.

**CAUTION**

- **Before use, please verify whether the packages are intact, especially the packages of single use accessories. In case of any damage, do not apply it to patients.**

### 3.7.8 Unlocking the Screen in Locked Mode

If you set the screen lock, you need to input the correct passcode to unlock the screen after the display turns off.

1. If the screen is off, press the or key to turn the display on and access the [**Screen Locked**] menu.
2. Input the passcode to unlock the screen.

   Once the passcode is entered the screen is temporarily unlocked. If the is pressed or the device times out, the screen will lock again and a passcode must be entered.

### 3.7.9 Unlocking the Screen in View Only Mode

1. If the screen is off, press the or key to turn the display on.
2. Press the key to display the [**Screen Locked**] menu.
3. Input the passcode to unlock the screen.

   Once the passcode is entered the screen is temporarily unlocked. If the is pressed or the device times out, the screen will lock again and a passcode must be entered.

For details about setting the screen lock, refer to ***"Screen Lock Menu" on page 13 - 14***.

### 3.7.10 Acknowledging the Nurse Call

To acknowledge the triggered nurse call, tap [**Attendant Present**] in the main menu. The "Nurse Call Cancelled" message will display in the message area.

For details about how to trigger a nurse call, refer to ***"Physical View" on page 2 - 6***.

**WARNING**

- **Do not only rely on the nurse call function, the medical personnel should also pay close attention to the patient's condition.**

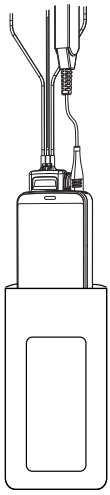
## 3.8 Using the Pouch

The TM80/TM70 is not intended for direct contact with the patient's skin. During normal use, the TM80/TM70 should be worn over clothing, in a pocket, or in a pouch. The water-proof pouch with clear front is an appropriate means for holding the TM80/TM70. Both disposable and reusable pouches specified in this manual can be used for the TM80/TM70. For details about the pouch, refer to ***"Miscellaneous" on page 18 - 6***.

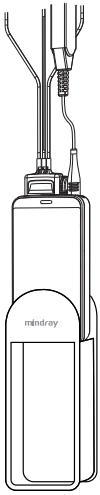
### 3.8.1 Securing the Pouch

To secure the pouch:

1. Place the TM80/TM70 into the pouch with the ECG leadwires and the $SpO_2$ sensor cable, if used, exiting from the pouch opening, as shown in the following figures.

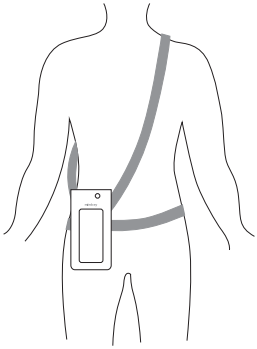


For disposable pouch

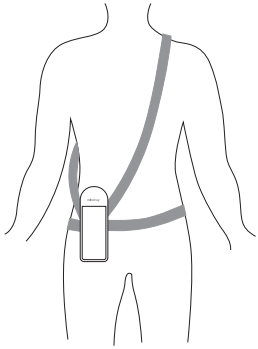



For reusable pouch

2. Pinch the snap-fastener to close the pouch.
3. Secure the pouch on the patient with ties around the patient's shoulder and under the arm, as shown in the following figure.



Wearing the disposable pouch



Wearing the reusable pouch

For more information on using the pouch, refer to ***Pouch Instructions for Use (P/N 046-007058-00)***.

**WARNING**

- **While using a pouch with the TM80/TM70 on the patient, consider the patient's condition. Be careful about the placement of the straps, as the straps could present a strangulation hazard.**

**NOTE**

- **The pouch is used only for the TM80/TM70. The pouch cannot be used for carrying other personal devices, such as a mobile phone.**

# 4 User Configurations

# 4.1 Introduction

This chapter describes the configurations available for users to do, such as configuring the Display Setup, and Audio Volume.

# 4.2 Configuring the Display

You can configure the display layout, display orientation, and screen brightness in the [**Display Setup**] menu.

## 4.2.1 Entering the Display Setup Menu

To enter the [**Display Setup**] menu, follow this procedure:

1. Press  to enter the main menu.
2. Tap [**Display Setup**].

## 4.2.2 Configuring the Default Display Orientation

For details about the display orientation, refer to ***"Understanding the Screen Display Orientation" on page 3 - 10***.

To configure the default display orientation, follow this procedure:

1. In the [**Setup**] section of the [**Display Setup**] menu, tap [**Default Orientation**].

   Two buttons display: [**Portrait**] and [**Landscape**].
2. Tap a button to set the default orientation.

   The selected orientation displays to the right of [**Default Orientation**].
3. Restart the equipment to apply the setting.

## 4.2.3 Understanding Portrait Orientation Display Rules

In portrait orientation, both digital and waveform areas take up the entire width of the screen. Therefore, these parameters will be displayed in the exact order of the [**Display Setup**] menu, provided the sensor is attached and monitoring data.

## 4.2.4 Configuring the Portrait Display

To configure the portrait display, follow this procedure:

1. In the [**Portrait**] section of the [**Display Setup**] menu, tap [**Rows**].

   Three options display: [**2**], [**3**], and [**4**].

2. Tap an option to set the row numbers.

   The selected option displays to the right of [**Rows**].

3. Tap [**Portrait Order**] to enter the [**Portrait Order**] menu.

4. Tap a parameter or waveform to select it.

   The  icon displays to the right of the selected parameter or waveform.

5. Drag the selected parameter or waveform to the desired position, and then release it.

6. Repeat steps 4 and 5 until the desired order is configured.

7. Tap the  icon to exit the [**Portrait Order**] menu.

## 4.2.5 Understanding Landscape Orientation Display Rules

In landscape orientation, waveform areas take up the entire width of the screen. Digital areas only take up one half of the width of the screen. The following rules define how the tiles will be laid out:

1. The areas shall be displayed in the order of the [**Display Setup**] menu except the digital area locations shall be optimized to reduce blank tiles.
2. A waveform area always takes up the entire width of the screen.
3. A digital area always takes up one half of the width of the screen. Therefore, a row with a digital tile in it shall be split into two half tiles.
4. A digital area shall not be the only parameter in a row unless an odd number of digital areas exist. In this case, the last digital parameter area shall have one tile on the left side and the right half will be blank.
5. Digital areas shall be paired with the next available digital area to satisfy rule 4. This means that a digital area may be moved ahead of a waveform area if a half of a row needs to be filled.

## 4.2.6 Configuring the Landscape Display

To configure the landscape display, follow this procedure:

1. In the [**Landscape**] section of the [**Display Setup**] menu, tap [**Rows**].

   Three options display: [**2**], [**3**], and [**4**].

2. Tap an option to set the row numbers.

   The selected option displays to the right of [**Rows**].

3. Tap [**Landscape Order**] to enter the [**Landscape Order**] menu.

4. Tap a parameter or waveform option to select it.

   The  icon displays to the right side of the selected parameter or waveform.

5. Drag the selected parameter or waveform to the desired position, and then release it.
6. Repeat steps 4 and 5 until the desired order is configured.
7. Tap the  icon to exit the [**Landscape Order**] menu.

### 4.2.7 Configuring the Display Brightness

To configure the display brightness, follow this procedure:

1. In the [**Setup**] section of the [**Display Setup**] menu, tap [**Display Brightness**].

   The [**Display Brightness**] menu displays.

2. Drag the slider to left or right to adjust the brightness.
3. Tap the  icon to exit the [**Display Brightness**] menu.

## 4.3 Configuring the Audio Volume

You can independently set the alarm volume, touch screen click, and systole beep volume. The method for setting the three volumes are the same.

To change the volume settings, follow this procedure:

1. In the main menu, tap [**Audio Volume**].
2. In the [**Sounds**], [**Touch Screen Click**], or [**Systole Beep**] section, drag the slider to the left or right to adjust the volume.
3. Tap the  icon to exit the [**Audio Volume**] menu.

**NOTE**

- **The  icon indicates that the audio volume is turned off.**
- **The minimum value for the alarm volume depends on the minimum alarm volume, refer to *"Configuring the Alarms Menu" on page 13 - 4* for details.**

# 5 Patient Management

# 5.1 Introduction

The chapter describes how to admit a patient, change the patient category, enter and exit the Standby mode, and discharge the patient.

# 5.2 Admitting a Patient

After discharging the current patient, you can admit a new patient by pressing the button. For how to discharge a patient, refer to ***"Discharging the Patient" on page 5 - 4***. After admitting a patient, please check the patient category and make changes appropriately.

# 5.3 Changing Patient Information

You can change patient category, paced status, department name, room number, and bed number.

## 5.3.1 Changing the Patient Category

**NOTE**

- **Match the patient category selection to the actual patient before monitoring begins.**

1. In the main menu, tap [**Patient Info**].
2. In the [**Patient Info**] menu, tap [**Patient Category**] to select the desired patient category.

   The screen displays the "Are you sure you want to change the patient category?" message.
3. Select [**Yes**] to confirm the changing.

   The selected patient category displays to the right of [**Patient Category**].
4. Tap to save the settings and exit the [**Patient Info**] menu.

**NOTE**

- **When the device is connected to the CMS, the patient category at the CMS is updated if the patient category is changed at the TM80/TM70, and vice versa. Refer to the *BeneVision Central Monitoring System Operator's Manual (P/N 046-007960-00)* for details.**

### 5.3.2 Changing Paced Status

It is important to correctly set the patient's paced status before patient monitoring.

You can also set the patient's paced status from the [**ECG**] menu. For information regarding how to set paced status, refer to ***"Checking the Paced Status" on page 7 - 11***.

### 5.3.3 Changing Department Name, Room Number, and Bed Number

When modifying department name, room number, and bed number is allowed in the [**Maintenance**] menu, you can change a department name, room number, and bed number.

For more information on related settings in the [**Maintenance**] menu, refer to ***"Configuring Device Location" on page 13 - 4***.

To change department name, room number, and bed number:

1. In the main menu, tap [**Patient Info**].
2. In the [**Patient Info**] menu, tap [**Department**], [**Room No.**], or [**Bed No.**].
3. Enter the desired contents.

## 5.4 Placing a Device in Standby

**NOTE**

- **When the device is connected to the CMS and enters or exits Standby mode, the CMS is also notified to enter or exit Standby mode. Refer to the *BeneVision Central Monitoring System Operator's Manual (P/N 046-007960-00)* for details.**

To enter the Standby mode:

1. In the main menu, tap [**Standby**].
2. In the [**Standby**] confirmation menu, tap [**Yes**].

Placing a device into Standby mode does the following:

- Suspends patient monitoring
- Alarm system is suspended
- Removes all patient data from the screen and displays [**Standby**] on the screen.
- The screen display automatically turns off after the device enters the Standby mode for 30 seconds.
- CMS is notified.

## 5.5 Exiting the Standby Mode

Press the key to exit Standby mode.

After you exit the Standby mode, the system responds as follows:

- Restores parameter measurement as previously configured.
- Alarm system is activated.
- The TM80/TM70 notifies the CMS of returning to the Monitoring mode.

## 5.6 Discharging the Patient

When the TM80/TM70 is connected to the CMS, discharging the patient will stop monitoring at the TM80/TM70 and CMS.

After discharging the patient, the patient's configuration is cleared at the TM80/TM70. The TM80/TM70 can admit next new patient by applying the user configuration. If the TM80/TM70 does not save the user configuration, it will load the departmental settings sent by the CMS for the new patient.

You can discharge the patient by selecting the [**Discharge Patient**] menu or restarting the TM80/TM70.

**NOTE**

- **When the TM80/TM70 is connected to a CMS, the patient being discharged from the TM80/TM70 is also discharged from the CMS. Refer to the *BeneVision Central Monitoring System Operator's Manual (P/N 046-007960-00)* for details.**

### 5.6.1 Selecting the [Discharge Patient] menu

1. In the main menu, tap [**Discharge Patient**].
2. In the [**Discharge Patient**] confirmation menu, select [**Yes**].
   - The patient is discharged from both the TM80/TM70 and the CMS.
   - The patient's configuration is cleared and the default departmental settings are restored.
   - The [**Discharged Pat.**] window of the CMS adds a record of the patient's history data.
3. Press the key to start monitoring by applying the default departmental settings.

### 5.6.2 Restarting the TM80/TM70

1. If the TM80/TM70 is powered off, press the  key to turn on the device.

   The device prompts whether this is a new patient or not.

2. Select [**Yes**] to enter the [**Discharge Patient**] confirmation menu.
3. Select [**Yes**] to clear the current patient's configuration and start monitoring by applying the user configuration.

   If the TM80/TM70 does not save the user configuration, it will apply the default departmental settings sent by the CMS for the new patient.

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# 6 Alarms

## 6.1 Introduction

Alarms, triggered by abnormal vital signs or technical problems, are visually and audibly indicated to the user when the display is on.

For the full list of alarm messages displayed at the TM80/TM70, refer to ***"Troubleshooting" on page 15 - 1***.

## 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.**
- **If the TM80/TM70 is connected to the CMS, alarms can be presented and controlled at the CMS. Remote suspension or reset of alarms at the CMS may cause a potential hazard. For more information, refer to B*eneVision Central Monitoring System Operator's Manual*.**
- **The TM80s/TM70s in your care area may each have different alarm settings to suit different patients. Always check that the alarm settings are appropriate for your patient before starting 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.**
- **When the alarm sound is switched off, the TM80/TM70 gives no alarm tones even if a new alarm occurs. Be careful about whether to switch off the alarm sound or not. 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.**

**WARNING**

- **Always make sure that the audio alarm volume level is adequate in your care environment. Always keep the patient under close surveillance.**
- **The reception failure of alarm signals may occur in the distributed alarm system.**

## 6.3 Alarm Categories

The alarms can be classified into two categories: physiological alarms and technical alarms. Alarm messages are displayed in the message area on the main screen.

- Physiological alarms, also called patient status alarms, are triggered by a monitored parameter value that violates set alarm limits or an abnormal patient condition.
- Technical alarms, also called system status alarms, are triggered by a device malfunction or a patient data distortion due to improper operation or mechanical problems.

Apart from the physiological and technical alarm messages, the TM80/TM70 will show some messages telling the system status.

## 6.4 Alarm Levels

The alarms can be classified into three severity levels: high level, medium level and low level.

| Alarm Levels | Physiological Alarms | Technical Alarms |
|---|---|---|
| High level | Indicates that the patient is in a life threatening situation, such as Asystole V-Fib/ V-Tac and so forth, and an emergency treatment is required. | Indicates a severe device malfunction or an improper operation, which could make it possible that the monitor cannot detect critical patient status and thus threaten the patient's life, such as low battery. |
| Medium level | Indicates that the patient's vital signs appear abnormal and immediate treatment is required. | Indicates a device malfunction or an improper operation, which may not threaten the patient's life but may compromise the monitoring of vital physiological parameters. |
| Low level | Indicates that the patient's vital signs appear abnormal and immediate treatment may be required. | Indicates a device malfunction or an improper operation, which may compromise a certain monitoring function but will not threaten the patient's life. |

| Alarm Levels | Physiological Alarms | Technical Alarms |
|---|---|---|
| Message | Provides additional information on the patient status. | Provides additional information on the system status. |

# 6.5 Alarm Indicators

When an alarm occurs, the TM80/TM70 notifies the user through visual or audible alarm indications.

- Alarm light
- Audible alarm tones
- Flashing numerics
- Alarm message

**NOTE**

- **When the display is off, the user must activate the screen to view any local alarms.**

## 6.5.1 Alarm Light

If an alarm occurs, the alarm light on the TM80/TM70 flashes. The color and flashing frequency correspond to the alarm level as follows:

- High level alarms: the lamp quickly flashes red.
- Medium level alarms: the lamp slowly flashes yellow.
- Low level alarms: the lamp lights cyan without flashing.

## 6.5.2 Alarm Tones

The TM80/TM70 has three alarm tone configurations: ISO, Mode 1 and Mode 2. For each configuration, the alarm tones enunciate the alarm levels as follows:

- ISO pattern:
  - High level alarms: triple+double+triple+double beep
  - Medium level alarms: triple beep
  - Low level alarms: single beep
- Mode 1:

- High level alarms: high-pitched single beep
- Medium level alarms: double beep
- Low level alarms: low-pitched single beep

■ Mode 2:

- High level alarms: high-pitched triple beep
- Medium level alarms: double beep
- Low level alarms: low-pitched single beep

**NOTE**

- **When multiple alarms of different levels occur simultaneously, the TM80/TM70 selects the alarm of the highest level to light the alarm light and sound alarms accordingly, while all the alarm messages scroll in the message area on the top of the screen.**
- **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.**

## 6.5.3 Flashing Numeric

If an alarm triggered by an alarm limit violation occurs, the numeric of the measurement in alarm will flash every second, and the corresponding alarm limit will also flash at the same frequency indicating the high or low alarm limit is violated.

## 6.5.4 Alarm Messages

When an alarm occurs on the screen, the alarm message appears in the message area. The background color of the alarm message and the asterisk symbols (*) before the alarm message are designed to indicate the alarm level.

| Alarms | Background color | Asterisk symbols (*) |
|---|---|---|
| High level alarms | red | *** |
| Medium level alarms | yellow | ** |
| Low level alarms | cyan | * |

You can view the alarm messages by selecting the message area. Refer to ***"Display Screen" on page 2 - 8*** for details.

### 6.5.5 Alarm Status Symbols

The TM80/TM70 still uses the following symbols indicating the alarm status:

- : indicates that all the alarms are paused.
- : indicates the technical alarm audio is turned off.
- : indicates the alarm system is reset.

## 6.6 Viewing Alarm List

1. Tap the message area on the main screen. The [**Alarm List]** menu is displayed.
2. In the [**Physiological Alarms**] section, you can view the number of physiological alarms and alarm messages.
3. In the [**Technical Alarms**] section, you can view the number of technial alarms and alarm messages.

## 6.7 Configuring the Alarms

You can set alarm-related items such as alarm properties, alarm volume, and alarm setup menu. For how to set alarm volume and alarm setup menus, refer to ***"Configuring the Audio Volume" on page 4 - 4*** and ***"Configuring the Alarms Menu" on page 13 - 4*** respectively.

### 6.7.1 Changing Alarm Properites

You can change alarm properties for parameters collectively or individually.

To change alarm properties, follow this procedure:

1. Enter the [**Alarm Limit**] menu in either of the following ways:
   - Press the key to enter the main menu →tap [**Alarms**] →tap [**Alarm Limits**].
   - Tap the desired digital area or waveform area to enter corresponding parameter setup menu → from the [**Alarms**] section tap alarm-related option.
2. In the [**Alarm Limits**] section, switch on or off a parameter alarm.
3. Tap the desired parameter to enter its alarm setup menu.
4. In the [**Limits**] section, tap the alarm limit which you want to change.
5. Enter the new alarm limt.
6. Tap to return to the parameter alarm setup menu.
7. In the [**Responses**] section, set the desired alarm priority.

**NOTE**

- **When the TM80/TM70 is connected to the CMS, any changes to the alarm properties at the TM80/TM70 or the CMS will be communicated to the other side to make sure that the alarm settings are consistent.**

## 6.7.2 Initiating Auto Alarm Limits

The TM80/TM70 provides the auto alarm limits function to automatically adjust alarm limits according to the patient's vital signs used. When auto limits are selected, the TM80/TM70 calculates safe auto limits based on the latest measured values. To get accurate auto alarm limits, you need to collect a set of measured vital signs as a baseline.

To initiate auto alarm limits, follow this procedure:

1. Press the key to enter the main menu.
2. Tap [**Alarms**].
3. Tap [**Alarm Limits**]. The [**Alarm Limits**] menu is displayed.
4. Tap [**Auto Limits**].
5. In the dialog that pops up, tap [**OK**].

Then the TM80/TM70 will automatically calculate alarm limits based on the latest measured values. Before applying these automatically created alarm limits, confirm if they are appropriate for your patient from the Limits menu. If not, you can adjust them manually. These alarm limits will remain unchanged until you select auto limits again or adjust them manually.

The TM80/TM70 calculates auto limits basing on the following rules:

| Module | Parameter | Lower Limit | Upper Limit | Auto Limit Range |
|---|---|---|---|---|
| | | Adult/ Pediatric | Adult/ Pediatric | |
| ECG | HR/PR (bpm) | (HR/PR×0.8) or 40 (whichever is greater) | (HR/PR×1.25) or 240 (whichever is smaller) | Adult/pediatric: 35~240 |
| Resp | RR (rpm) | (RR×0.5) or 6 (whichever is greater) | (RR×1.5) or 30(whichever is smaller) | Adult/pediatric: 6~55 |
| $SpO_2$ | $SpO_2$ (%) | Same as the default alarm limit | Same as the default alarm limit | Same as the measurement range |

| Module | Parameter | Lower Limit | Upper Limit | Auto Limit Range |
|---|---|---|---|---|
| | | Adult/ Pediatric | Adult/ Pediatric | |
| NIBP | NIBP-S (mmHg) | (SYS×0.68 + 10) | SYS×0.86 + 38 | Adult: 45~270<br>Pediatric: 45~185 |
| | NIBP-D (mmHg) | (Dia×0.68 + 6) | (Dia×0.86 + 32) | Adult: 25~225<br>Pediatric: 25~150 |
| | NIBP-M (mmHg) | (Mean×0.68 + 8) | Mean×0.86 + 35 | Adult: 30~245<br>Pediatric: 30~165 |

### 6.7.3 Restoring the Default Alarm Settings

1. Press the key to enter the main menu.
2. Tap [**Alarms**].
3. Tap [**Alarm Limits**]. The [**Alarm Limits**] menu is displayed.
4. Tap [**Defaults**].
5. In the dialog that pops up, tap [**OK**].

## 6.8 Pausing Alarms

When an alarm occurs, follow this procedure to pause the alarm system.

- Press the key to enter the main menu, and then tap [**Alarm Pause**] from the [**Commands**] section.

OR

1. Flick your finger up at the bottom of the main screen to display the quick keys area.
2. Tap the [**Alarm Pause**] quick key.

When alarms are paused, the following indicators are given:

- No physiological alarm will be presented within the alarm pause time.
- For technical alarms, alarm sounds are paused, but the alarm lamp and alarm messages remain presented.
- The remaining alarm pause time is displayed in the message area.
- The alarm pause symbol is displayed in the upper right corner of the main screen.

The alarm pause time is two minutes. When the pause time expires, the alarm paused status is automatically deactivated. You can also cancel the alarm paused status by tapping [**Alarm Pause**] in the quick keys area.

**NOTE**

- **When the TM80/TM70 is connected to the CMS and the function of remotely pausing alarms is enabled at the CMS, alarms can be paused either at the TM80/TM70 or at the CMS. For information on pausing alarms at the CMS, refer to *BeneVision Central Monitoring System Operator's Manual*.**

## 6.9 Resetting Alarms

You can acknowledge the on-going alarms by resetting the alarms. After being reset, the alarm reset symbol  is displayed in the message area.

When an alarm occurs, follow this procedure to reset the TM80/TM70's alarm system.

■ Press the  key to enter the main menu, and then tap [**Alarm Reset**] from the [**Commands**] section.

OR

1. Flick your finger up at the bottom of the main screen to display the quick keys area.
2. Tap the [**Alarm Reset**] quick key to reset the alarm system.

**NOTE**

- **When the TM80/TM70 is connected to the CMS and the function of remotely resetting alarms is enabled at the CMS, alarms can be reset either at the TM80/TM70 or at the CMS. For information on resetting alarms at the CMS, refer to *BeneVision Central Monitoring System Operator's Manual*.**

### 6.9.1 Resetting Physiological Alarms

After the alarm system is reset, physiological alarms give the following alarm indicators:

■ The alarm sound is silenced.

■ The  symbol appears in the message area.

- A √ mark 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.

### 6.9.2 Resetting Technical Alarms

After the alarm system is reset, technical alarms give the following alarm indicators:

- The  symbol appears in the message area.
- Some technical alarms are cleared and no alarm indications are given.
- Some technical alarms are changed to prompt messages.
- For some technical alarms, the alarm sound will be silenced, the alarm light will continue to indicate the alarm, a √ markwill appear before the alarm message.

For details about the indications of technical alarms when the alarm system is reset, refer to ***"Technical Alarm Messages at the TM80/TM70" on page 15 - 5***.

## 6.10 Latching Alarms

When physiological alarms are latched, the time when the alarm is last triggered is displayed behind the alarm message. Besides, resetting or pausing alarms via the TM80/TM70 or the CentralStation clears latched alarms.

**NOTE**

- **Latching settings for physiological alarms are configured at the CentralStation. For more information on how to configure latching settings, refer to *BeneVision Central Monitoring System Operator's Manual (P/N 046-007960-00)*.**

## 6.11 Actions When an Alarm Occurs

When an alarm occurs, observe the following steps and take proper actions:

1. Check the patient's condition.
2. Confirm the alarming parameter or alarm category.
3. Identify the source of the alarm.
4. Take proper action to eliminate the alarm condition.
5. Make sure the alarm condition is corrected.

For more information, refer to ***"Troubleshooting" on page 15 - 1***.

# 7 Monitoring ECG

# 7.1 Introduction

The electrocardiogram (ECG) measures the electrical activity of the heart and displays it on the monitor as a waveform and a numeric.

ECG monitoring provides 3-, 5-, and 6-lead ECG monitoring, ST-segment analysis, arrhythmia analysis, and QT/QTc measurements.

Operations such as configuring QRS threshold, adjusting ST point/ISO point/J point, setting ST template/QT template are performed at the CentralStation. For details about these operations, refer to ***Chapter 12 Monitoring with the TM80/TM70 at the CMS.***

# 7.2 Safety

**WARNING**

- **This equipment is not suitable for direct cardiac application.**
- **Use manufacturer specified electrodes and lead wires.**
- **Make sure the conductive parts of electrodes and associated connectors for applied parts, including the neutral electrode, do not contact any other conductive parts including earth.**
- **Periodically inspect the electrode application site to ensure skin quality. If the skin quality changes, replace the electrodes or change the application site.**
- **Use defibrillation-proof ECG leadwires during defibrillation.**
- **Do not touch the patient or any device connected to the patient, including the bed and gurney, during defibrillation. Otherwise serious injury or death could result.**

**CAUTION**

- **Interference from a non-grounded instrument near the patient and electro-surgery interference can cause problems with the waveform.**

**NOTE**

- **After defibrillation, the waveform recovers within 10 seconds applied in accordance with the manufacturer's instructions for use.**

# 7.3 Preparation for Monitoring ECG

## 7.3.1 Preparing the Patient's Skin

Proper skin preparation is essential in obtaining an accurate ECG reading. Electrode sites should be clean and dry and should provide a smooth flat surface. Incidental electrical activity and inaccurate readings may arise from incorrect skin preparation.

The following procedure is recommended for secure electrode application:

1. Shave the chest hair from the electrode sites in a circular area with a diameter of 2 to 4 inches.
2. Use a dry gauze pad to remove excess skin oils, skin cells and residue from the electrode sites. Never rub the skin until it is raw or bleeding.

**NOTE**

- **Prepare the electrode site with alcohol only if the skin is extremely greasy. If alcohol is used as a drying agent, always allow the skin to dry before placing the electrode on the skin.**

## 7.3.2 Positioning the Electrodes

**NOTE**

- **Store electrodes at room temperature and open just prior to use.**
- **Avoid more than one type of electrode on a patient because of variations in electrical resistance.**
- **Avoid placing electrodes directly over bone prominences or over any high activity movement areas such as shoulders or arms because muscle motion produces electrical activity. If an electrode is placed over a large muscle such as the pectorals, the device may detect this additional muscle activity and could lead to false arrhythmia calls.**

## NOTE

- **Using a Transcutaneous Electrical Nerve Stimulator (TENS): Since a TENS unit transmits electrical impulses, avoid placing ECG electrode near the TENS electrodes. ECG electrodes may need to be repositioned and the ECG lead viewed may need to be adjusted until the optimum ECG tracing is obtained.**

1. Peel the backing off of the electrode. Visually inspect the contact gel medium for moistness. If the gel medium is not moist, do not use the electrode patch. Dry electrode patches are not conductive.

## NOTE

- **To prevent evaporation of the contact gel medium, peel the backing off of the electrode patch only when it is ready for use.**
- **If using the snap type lead wires, attach the electrode to the lead wire before placing the electrode on the patient.**

2. Attach the electrode patch to the skin at the prepared site. Smooth the electrode patch down in a circular motion to ensure proper skin contact. If using soft gel electrodes, never push down directly over the contact gel medium as this may displace the gel and cause monitoring artifact. If using hard gel electrodes, it is recommended that during application, the center of the electrode should be slightly pressed onto the skin to ensure direct contact. Consult the electrode manufacturer's instructions for specific use.
3. Secure the lead wires to the patient according to hospital practice.

## CAUTION

- **Route leadwires neatly. Ensure leadwires are kept away from patient's neck to avoid strangulation. Keep floors and walkways free of cables to reduce risk to hospital personnel, patients and visitors.**

**NOTE**

- **It is recommended that the electrodes be changed at least every 24 to 36 hours to maintain proper contact with the skin, although some patients may require more frequent changing. Do not reapply disposable electrode. Try to avoid reusing the exact same electrode site during reapplication. If an electrode becomes wet with fluid, change the electrode.**

## 7.3.3 Setting ECG Lead Labeling

### 7.3.3.1 Lead Naming Standards

This manual presents lead placement according to the guidelines of the American Heart Association (AHA) and the International Electro-Technical Commission (IEC).

| Lead position | AHA | | IEC | |
|---|---|---|---|---|
| | Label | Color | Label | Color |
| Chest | V | Brown | C | White |
| Left Leg | LL | Red | F | Green |
| Right Leg | RL | Green | N | Black |
| Left Arm | LA | Black | L | Yellow |
| Right Arm | RA | White | R | Red |

### 7.3.3.2 Choosing Lead Labeling

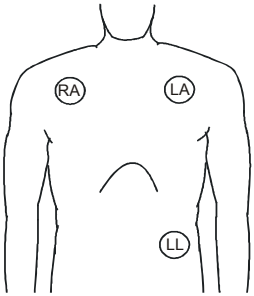
For details on choosing the lead labeling, refer to ***"Configuring the General Menu" on page 13 - 2***.

## 7.3.4 Placing the Electrodes

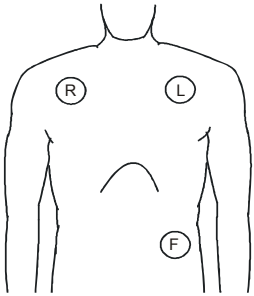
For lead placement, the ECG algorithm works best when the patient's R wave is significantly larger than the P wave or the T wave. If the R wave is not significantly larger than other lower voltage waves on the ECG tracing, the monitor may have some difficulty in identifying the appropriate waves. On some patients, electrode placement and/or the viewed ECG lead may need to be adjusted in order to obtain a significant R wave.

### 7.3.4.1 Standard 3-Leadwire Electrode Placement

A 3-wire lead set can monitor one of three ECG vectors (I, II, or III). The recommended 3-wire lead placement is as follows:




3-wire lead placement (AHA)



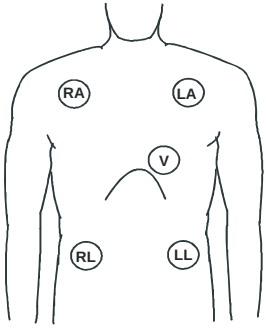

3-wire lead placement (IEC)

- Place the RA (white) electrode under the patient's right clavicle, at the mid-clavicular line within the rib cage frame.
- Place the LA (black) electrode under the patient's left clavicle, at the mid-clavicular line within the rib cage frame.
- Place the LL (red) electrode on the patient's lower left abdomen within the rib cage frame.

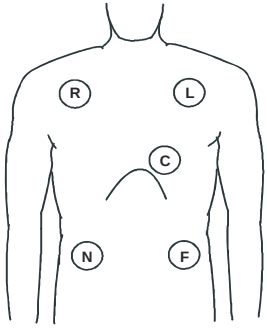
- Place the R (red) electrode under the patient's right clavicle, at the mid-clavicular line within the rib cage frame.
- Place the L (yellow) electrode under the patient's left clavicle, at the mid-clavicular line within the rib cage frame.
- Place the F (green) electrode on the patient's lower left abdomen within the rib cage frame.

### 7.3.4.2 Standard 5-Leadwire Electrode Placement

A 5-wire lead set can monitor seven ECG vectors (I, II, III, aVR, aVL, aVF, and V) simultaneously. The recommended 5-wire lead placement is as follows:




5-wire lead placement (AHA)



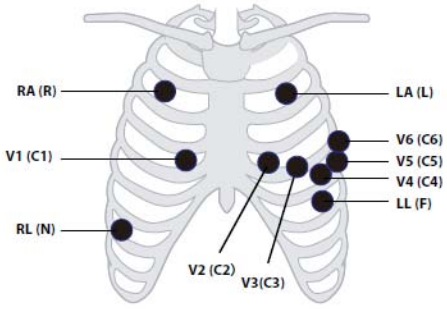

5-wire lead placement (IEC)

- Place the RA (white) electrode under the patient's right clavicle, at the mid-clavicular line within the rib cage frame.
- Place the LA (black) electrode under the patient's left clavicle, at the mid-clavicular line within the rib cage frame.
- Place the LL (red) electrode on the patient's lower left abdomen within the rib cage frame.
- Place the RL (green) electrode on the patient's lower right abdomen within the rib cage frame.
- Place the V (brown) electrode in one of the V-lead positions (V1 to V6) depicted in the following table.
- Place the R (red) electrode under the patient's right clavicle, at the mid-clavicular line within the rib cage frame.
- Place the L (yellow) electrode under the patient's left clavicle, at the mid-clavicular line within the rib cage frame.
- Place the F (green) electrode on the patient's lower left abdomen within the rib cage frame.
- Place the N (black) electrode on the patient's lower right abdomen within the rib cage frame.
- Place the C (white) electrode in one of the C-lead (C1 to C6) positions depicted in the following table.

### 7.3.4.3 Standard 6-Leadwire Electrode Placement

For a 6-lead placement, use the positions from the 5-lead diagram above but with two chest leads. The two chest leads are Va and Vb per AHA standard, and are Ca and Cb per IEC standard. Va (Ca) and Vb (Cb) can be positioned at any two of the V1 (C1) to V6 (C6) positions shown in the chest electrode diagram below. The default position of Va and Ca is V1 and C1 respectively. The default position of Vb and Cb is V2 and C2 respectively

The positions of Va (Ca) and Vb (Cb) can also be placed at a proper position according to the clinician's needs.

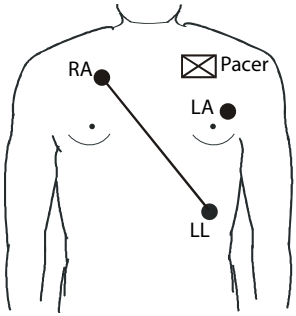



| AHA | IEC | Electrode Placement |
|---|---|---|
| RA (white) | R (red) | Under the patient's right clavicle, at the mid-clavicular line within the rib cage frame. |

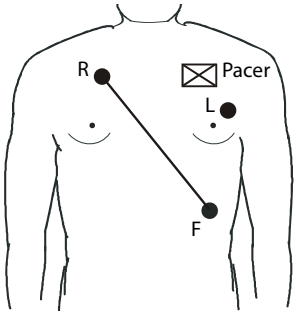
| AHA | IEC | Electrode Placement |
|---|---|---|
| LA (black) | L (yellow) | Under the patient's left clavicle, at the mid-clavicular line within the rib cage frame |
| LL (red) | F (green) | On the patient's lower left abdomen within the rib cage frame. |
| RL (green) | N (black) | On the patient's lower right abdomen within the rib cage frame. |
| Va (brown) | Ca (white) | The Va (Ca) electrode is placed in any one of the position from V1 (C1) to V6 (C6). By default, the Va electrode is placed at V1 while the Ca electrode is placed at C1. |
| V1 (brown) | C1 (white) | In the fourth intercostal space, right sternal border. |
| V2 (brown) | C2 (white) | In the fourth intercostal space, left sternal border. |
| V3 (brown) | C3 (white) | In the midway between V2 and V4 on a straight line. |
| V4 (brown) | C4 (white) | In the fifth intercostal space, mid-clavicular line. |
| V5 (brown) | C5 (white) | In the fifth intercostal space, anterior axillary line. |
| V6 (brown) | C6 (white) | In the fifth intercostal space, mid-axillary line. |

#### 7.3.4.4 Lead Placement: Pacemaker Patients

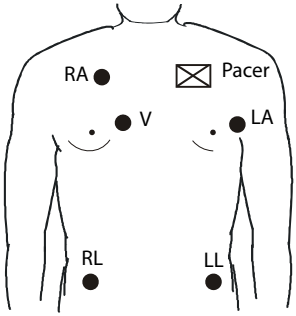
The recommended lead placement for monitoring a pacemaker patient is as follows.



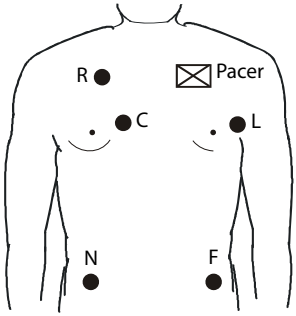

3-wire lead placement for a pacemaker patient (AHA)



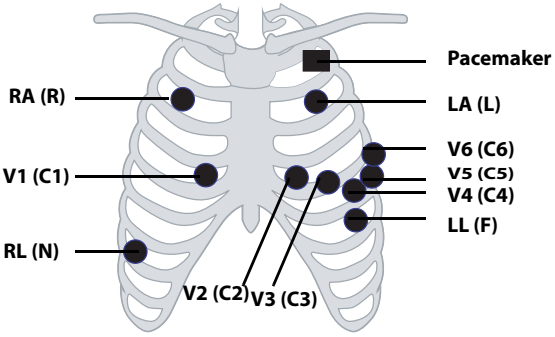

3-wire Lead Placement for a Pacemaker Patient (IEC)




5-wire Lead Placement for a Pacemaker Patient (AHA)




5-wire Lead Placement for a Pacemaker Patient (IEC)




6-wire Lead Placement for a Pacemaker Patient (AHA)/(IEC)

A pacemaker patient usually requires a different electrode patch placement configuration than a non-pacemaker patient.

Do not place an ECG electrode directly over the pacemaker generator. Place the electrode patches 3 to 5 inches away from the pacemaker generator area. For example, if the pacemaker generator is located in the right subclavian area, relocate the Right Arm electrode closer in towards the center of the chest.

## 7.3.5 Checking the Lead Placement

With the Lead Placement function, you can check the lead status, information, and lead off messages.

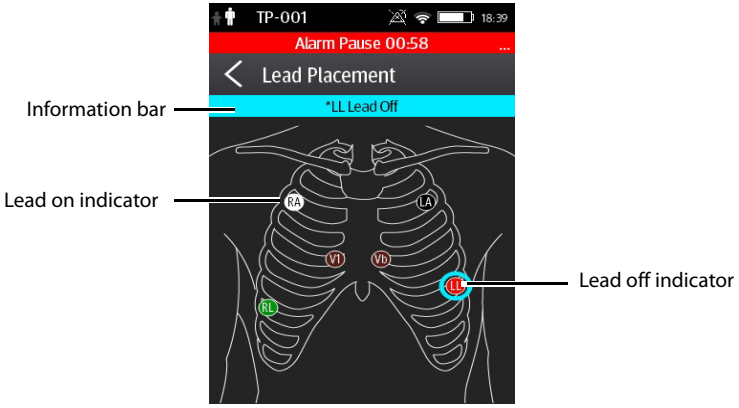
### 7.3.5.1 Entering the Lead Placement Menu

Enter the [**Lead Placement**] menu in either of the following ways:

- Tap the lead fault message in the message area of the main screen.
- In the main menu, tap [**Lead Placement**].

### 7.3.5.2 Understanding the Lead Placement Instructions

The [**Lead Placement**] window indicates the lead status.




Example lead placement window

When any of the leads are off, the indications are as follows:

- The lead off message displays on the information bar.

  The background color of the information bar corresponds to the alarm level.

- A flashing circle indicates the disconnected lead.

  The color of the flashing circle is based on the alarm level.

### 7.3.6 Checking the Paced Status

It is important to correctly set the patient's paced status before you start monitoring ECG.

To check the paced status:

1. On the main screen, tap the HR digital area or ECG waveform area to enter the [**ECG**] menu.
2. In the [**Pacer**] section, check the setting of the paced status.

   The current paced status setting displays to the right of [**Paced**].
3. If the paced status setting is not correct, tap [**Paced**] and select the correct paced status.

You can also change the patient's paced status from the [**Patient Info**] menu. For more infomration, refer to ***"Changing Paced Status" on page 5 - 3***.

- When [**Paced**] is set to [**Yes**] at the TM80/TM70, if the pacer pulse is detected, the  symbol displays in the waveform area of the CMS' screen, and the pace pulse marks will display on the ECG waveform both at the TM80/TM70 and CMS.

- When [**Paced**] is set to [**No**] or not specified at the TM80/TM70, the  symbol displays in the waveform area of the CMS' screen.

**WARNING**

- **For paced patients, you must set [Paced] to [Yes]. If it is incorrectly set to [No], the CMS could mistake a pace pulse for a QRS and fail to alarm when the ECG signal is too weak. Do not rely entirely on rate meter alarms when monitoring patients with pacemakers. Always keep these patients under close surveillance.**
- **The pacer pulses may be counted as QRS complexes, hence leading to wrong HR readings or failure to diagnose certain arrhythmia symptoms. Be sure to keep a close eye on patient's with pacemaker devices.**
- **For non-paced patients, you must set [Paced] to [No].**
- **False low heart rate indicators or false asystole calls may result with certain pacemakers because of pacemaker artifact such as electrical overshoot of the pacemaker overlapping the true QRS complexes.**
- **The radio frequency energy of the transmitter or other radio frequency sources, when used in close proximity to a pacemaker, may interfere with pacemaker performance. Internal pacemakers are less vulnerable than external pacemakers due to the shielding effects of the body. However, caution should be exercised when monitoring any paced patient.**
- **In order to minimize the possibility of interference, place electrodes, leadwires and TM80/TM70 as far away from the pacemaker as possible.**

**NOTE**

- **When [Paced] is set to [Yes], the system does not detect PVC-related arrhythmia (including PVCs) resulting from pacemaker but still analyzes the normal QRS complex.**

## 7.4 Changing the ECG Settings

You can change the ECG settings from the [**ECG**] menu.

## 7.4.1 Configuring the ECG Setup

Enter the ECG menu in either of the following ways:

- On the main screen, tap the HR digital area or ECG waveform area to enter the [**ECG**] menu.
- In the main menu, tap [**Parameter Setup**] → [**ECG**] to enter the [**ECG**] menu.

1. In the [**Setup**] section of the [**ECG**] menu, select the options described in the following table.

| Options | Description | Settings* |
|---|---|---|
| Lead Placement | Enters the [**Lead Placement**] window. | Refer to ***"Checking the Lead Placement" on page 7 - 10*** for details. |
| Cable Type | Selects the current ECG leadwire type. | **Auto**, 3 Lead, 5 Lead, 6 Lead<br>Refer to ***"Configuring the Pacer" on page 7 - 15*** for details. |
| Smart Lead (Monitored Lead) | When [**Cable Type**] is set to [**Auto**], the option displays [**Smart Lead**].<br>Drag the switch to right or left to enable or disable the Smart Lead function.<br><br>When [**Cable Type**] is set to [**3 Lead**], the option displays [**Monitored Lead**].<br><br>Refer to ***"Configuring the Pacer" on page 7 - 15*** for details. | |
| Filter | Selects the ECG filter.<br><br>Monitor<br>Use under normal measurement conditions.<br><br>ST<br>Use when ST monitoring is applied. | **Monitor**, ST |
| Color | Selects the ECG waveform color. | 16 colors<br>The default color is green. |

* *The factory default settings are in bold.*

2. Tap  to exit the [**ECG**] menu.

## 7.4.2 ECG Leadwire Types

ECG leadwire type has three options as follows:

- [**Auto**]: the device automatically sets the leadwire type according to the leads connected.
- [**3 Lead**]: the leadwire type is set to 3-lead.

  If the leadwire type is set to 3-lead, the [**Smart Lead**] option becomes [**Monitored Lead**]. You can select the desired lead from the [**Monitored Lead**] option to set the first ECG waveform displayed on the main screen.
- [**5 Lead**]: the leadwire types is set to 5-lead.

  All waveform leads display on the main screen.
- **[6 Lead]**: the leadwire types is set to 6 lead.

  If the leadwire type is set to 6 lead, there will be two options [**Va**] and [**Vb**] displayed under [**Cable Type**].

  - [**Va**] options: Va, V1, V2, V3, V4, V5, V6. Va is the default.
  - [**Vb**] options: Vb, V1, V2, V3, V4, V5, V6. Vb is the default.

## 7.4.3 Configuring the ECG Waveforms

1. In the [**Waveform**] section of the [**ECG**] menu, select the options described in the following table.

| Options | Description | Settings* |
|---|---|---|
| All Lead Size | Selects the waveform size for all the leads.<br>To set the waveform size for a specific lead, select that lead from the [**Waveform Size**] field. | 1.25 mm/mV, 2.5 mm/mV, 5 mm/mV, **10 mm/mV**, 20 mm/mV, 40 mm/mV, Auto |
| | This configuration will be applied for all ECG waveform size. | |
| Speed | Selects the waveform sweep speed. | 6.25 mm/s, **12.5 mm/s**, 25 mm/s |

* *The factory default settings are in bold.*

2. Tap  to exit the [**ECG**] menu.

## 7.4.4 Configuring the Pacer

1. In the [**Pacer**] section of the [**ECG**] menu, tap the options described in the following table.

| Options | Description | Settings* |
|---|---|---|
| Paced | Selects the paced status. | **Unspecified**, No, Yes<br>[**Unspecified**] is only available for the first time you set the paced status.<br>Refer to ***"Checking the Paced Status" on page 7 - 11*** for details. |
| Markers | Selects the pacer indicator.<br><br>Line<br>A 1 cm line shows above each ECG waveform each time the pace pulse is detected.<br><br>Dot<br>A 2 mm dot shows above each ECG waveform each time the pace pulse is detected. | **Line**, Dot, Off |

* *The factory default settings are in bold.*

2. Tap  to exit the [**ECG**] menu.

**NOTE**

- **When [Paced] is set to [Yes], the [Makers] option can be available.**

## 7.4.5 Configuring the ECG Waveform Size

The [**Waveform Size**] section of the [**ECG**] menu lists all available leads. You can select the desired ECG lead to set the waveform size. For details about the waveform size setting, refer to ***"Configuring the Pacer" on page 7 - 15***.

### 7.4.6 Configuring ECG Alarm Settings

1. In the [**Alarms**] section of the [**ECG**] menu, tap [**ECG Alarm Setup**].The [**Alarm Limits]** menu is displayed.
2. Configure the option described in the following table.

| Options | Description | Settings* |
|---|---|---|
| HR/PR | Configures whether to trigger the HR or PR alarm. | **On**, Off |
| | | Alarm limit range:<br>15 bpm to 300 bpm<br>The default alarm upper limit is **120 bpm** for adult and is **160 bpm** for pediatric.<br>The default alarm lower limit is 50 **bpm** for adult and is **75 bpm** for pediatric. |
| | | Alarm priority: **Med**, High |
| *Note: HR/PR upper and lower alarm limit ranges are associated with the upper alarm limit range of Extreme Tachy and the lower alarm limit range of Extreme Brady.* | | |
| * *The factory default settings are in bold.* | | |

### 7.4.7 Setting the Notch Filter

Notch filter filters out AC line noise from the ECG waveform. Refer to ***"Configuring the General Menu" on page 13 - 2*** for details.

## 7.5 Configuring the HR Alarm Source

In most cases, the HR and PR numerics are identical. In order to avoid simultaneous alarms on HR and PR, the TM80/TM70 uses either HR or PR as its active alarm source.

To change the alarm source:

1. On the main screen, tap the HR digital area or ECG waveform area to enter the [**ECG**] menu.
2. In the [**ECGParameter Setup**] section, tap [**HR**].
3. In the [**Setup**] section, select the desired alarm source for [**Alarm Source**]. [**Auto**] is the default.
   - [**HR**]: if you want the HR to be the alarm source for HR/PR.
   - [**PR**]: if you want the PR to be the alarm source for HR/PR.

- [**Auto**]: the TM80/TM70 will use the heart rate from the ECG measurements as the alarm source whenever a valid heart rate is available. If the heart rate becomes unavailable, for example the ECG module becomes disconnected, the TM80/TM70 will automatically switch to PR as the alarm source.
- [**Both**]: both HR and PR are used as the alarm source for HR/PR.

**NOTE**

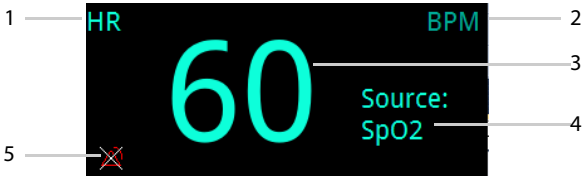
- **When [Alm Source] is set to [HR], systole beep comes from heart beat. When [Alm Source] is set to [PR], systole beep comes from pulse rate.**

# 7.6 Understanding the ECG Display

## 7.6.1 HR Digital Area

The HR digital area displays:

1. Parameter name
2. Measurement unit
3. Heart rate value
4. PR source: when ECG leads are not connected and valid PR value is detected, PR source is displayed.
5. Activation state off symbol: when HR/PR alarm is switched on and valid HR/PR value is detected, HR/PR alarm high and low limits in place of the activation state off symbol are displayed.




## 7.6.2 About the HR Digital Area

- The HR area displays heart rate in the unit of bpm with a resolution of 1 bpm.
- If the HR measurement is invalid, "- - -" displays in place of the HR value.
- The HR value displays "0", when the HR value is less than 15 bpm.
- When lethal arrhythmia alarms are switched off, corresponding alarm off message is displayed in the HR digital area.